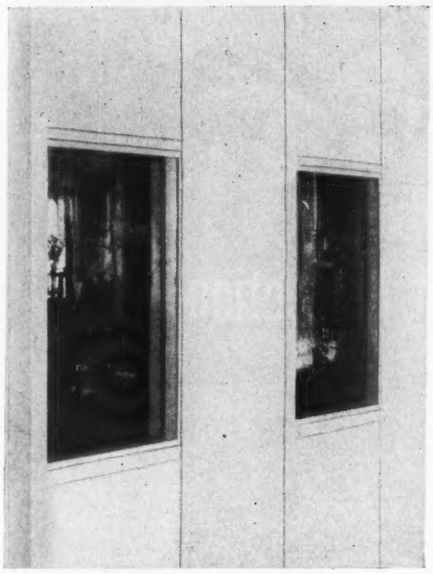

ONE BIG REASON why Factory is read by plant operating men throughout the length and breadth of the manufacturing industries is because it gives them a chance to peek through many another plant's windows and see what goes on there. Result is a swapping of ideas that couldn't possibly happen in any other way. For instance, we think there's an idea for hundreds of plant men back of the windows in the above photograph. So we are telling the story in an early issue. Don't miss it.

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Factory Management and Maintenance is a consolidation of *Factory and Industrial Management* (including *"Factory"*) and *Maintenance Engineering.*

Price 35c a copy. Subscription rates—United States, Canada, Mexico and Central and South American countries, $3 a year. All other countries, $4 a year or 16 shillings. Cable address "McGrawhill, New York." Member A.B.P. Member A.B.C.

Copyright, 1938, by McGraw-Hill Publishing Co., Inc.

Factory Management and Maintenance, July, 1938, Vol. 96; No. 7. Published monthly, McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42d Street, New York, N. Y. Entered as second class matter, November 13, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879.

Branch Offices: 520 North Michigan Ave. Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2, Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

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Factory
Management and Maintenance

L. C. MORROW, EDITOR

The Wage and Hour Law

WAGE AND HOUR legislation for industry, in prospect for several years, is now a fact. In less than three months the new law will go into effect for all employers "engaged in commerce or in the production of goods for commerce." The provisions of the act are good in comparison with those of earlier, rejected bills.

That it may have been unwise to enact the legislation is now beside the point. The administrator, and the boards he sets up, should have the fullest cooperation by industry. We are sure they will have.

The administrator of the Act will head a wage and hour division within the Department of Labor. He will appoint "industry committees," some hundreds of them eventually, consisting of representatives of the public, employees, and employers. These committees will recommend to the administrator the minimum rates and maximum hours to be followed by their industries.

Minimum wages may not be set at less than 25 cents for the first year, 30 cents for the next six years, and an amount between 30 and 40 cents thereafter, this amount to be set by the administrator. At no time may minimums be set at more than 40 cents, but minimums up to 40 cents may be set for specific industries at any time.

Hours must not be more than 44 per week for the first year, 42 for the second, 40 thereafter. Overtime at time and one-half is permitted. Exemptions are allowed for certain special forms of wage payment, such as the annual-wage method, and when employees are working under a collective-bargaining agreement approved by the National Labor Relations Board. Specified industries are allowed exemptions.

"Orders" as to minimum wages and maximum hours are to be issued by the Administrator, not the Boards. Rights of appeal are provided. Under the Act it will be unlawful to transport goods in violation of the wage and hour provisions or to discharge anyone who has filed a complaint. Penalties consist of fines and imprisonment.

The machinery of administration does not seem likely to bring about protracted and disrupting controversy between industry and a government bureau such as experienced in the administration of the National Labor Relations Act. The boards will be similar to the code authorities of the NRA, but will not have government representatives sitting with them, and will not be permanent organizations.

Sectional differentials are not provided for, but committees and administrator are obliged to consider, among other factors, competitive conditions as affected by transportation, living costs, and production costs. Committees are expected not to recommend minimums that will substantially curtail employment.

THESE PROVISIONS apparently provide a flexibility much needed in any legislation of this kind. Yet they make it necessary for the decisions of committees to be based on data that are exceedingly difficult of collection. Opinion and judgment must be depended upon to a great extent. It seems too much to hope that there will ever be a fair measurement of the effect of this act upon unemployment and the number of persons on relief rolls. Nor will there be a clear-cut demonstration that, economically, wages out of proportion to production cannot be paid.

It is to be hoped that the experiment will be tried wholeheartedly, but with equally earnest attempts to learn its weaknesses, even though they are such as to indicate the repeal of the Act, with consequent return of the responsibility to the states, where many industrialists and economists think it belongs.

Labor Boomerang in Akron

Nobody ever wins a labor war. Akron wage earners, in their misguided efforts to maintain wages at levels that make it impossible to compete with other sections, have been forced to sit and watch thousands of rubber-working jobs leave town

CHARLES B. COATES
Assistant Editor

AKRON, OHIO, a city ravaged by the fires of labor strife, is a living lesson to American industry. The visiting observer, if he cares to poke about the place a bit, can find much that is instructive to labor and management alike.

For industry, there is a warning against putting all your production eggs in one basket, or one city. For labor, there is a warning that you are killing the goose that laid the golden eggs when you enforce high wage differentials to the detriment of the city that suffers from them. For other communities there is a warning that constructive efforts to save an over-centralized city cannot be begun too soon. Akron's setbacks, caused by decentralization of the rubber industry in the last few years, have emphasized the truth of the maxim that nobody ever wins a war, including a labor war. Current efforts to save the situation dramatize vividly the handicaps that hamper a sincere employer in dealing with his employees under the Wagner Act. Akron's present plight is a strong argument for putting the secret ballot at the disposal of management as well as labor.

Akron, in 1929, had come a long, long way since the day in 1870 when Dr. B. F. Goodrich startled the sleepy villagers with his vision of a great, new industry. Rounding the turn of the century with a population of 42,000, the town boomed anew with the motor age. Hill people flocked down from the back country of Ohio and neighboring states. 1929 Akron made some famous boasts—two-thirds of all the tire and tube manufacturing in the United States; the highest wages in industry; 90 per cent of the town's population American-born; 50

per cent of its homes owner-occupied. Retail trade exceptionally brisk. And, in all of its hilly wooded length and breadth, few slums. Population 255,000. With the accelerator on the floorboard and the brakes disconnected, Akron roared slambang into the big depression.

That was a terrific jolt. Employment in rubber swooped from 44,741 in 1929, to 29,468 in 1931. The city's many municipal improvements were just reminders of the big headache that went with a bonded indebtedness of $45,315,000. Home ownership made it just that much tougher when lay-offs began and average yearly wages tumbled (1929 to 1933) from $1,662 to $1,055.

But Akron plugged along through the depression as gamely as any city. And it had one thought to comfort it—after all, wasn't it the rubber capital of the world?

It was. But now, after five years of mixed improvement, prosperity, and recession, let's take another look at Akron. Belatedly it is retiring $1,500,000 of depression "scrip." It has reduced its debt, largely by abstention from new improvements, to a net total of $39,787,568 But a recent bond issue went begging in the open market. The *New York Journal and American* reported that investors were driven off by news of local industrial conditions. With lay-offs in the rubber plants, clerical salaries were cut 10 per cent and executive salaries up to 20 per cent April 1 of this year.

"I wouldn't be surprised if 30 per cent of the stores here folded up in 30 days," said one merchant about the middle of May. This was plainly an exaggeration. But March department store sales were off 23.1 per cent from 1937 figures—3.3 per cent lower than the rest of the Cleveland district, 20 per cent lower than the national average.

Relief figures are zooming. In May this year, WPA rolls in Summit county, including Akron, hit an all-time high of 17,811. In Akron proper, the number of people on some form of relief shot from 24,000 in September, 1937, to 70,000 in May, 1938.* Total advertising linage in the two local newspapers swooped from 3,206,802 last October to 2,589,986 in March.

The value of new building permits in the first quarter of 1938 in 124 typical cities declined only 2 per cent from 1937.

In Akron the decline was 81.7 per cent!

"You could shoot a cannonball down the middle of Main Street at high noon and never hit a soul," mourned one young business man. But that's not quite correct. The cannonball in question would be bound to bowl over a sizable number of unemployed rubber workers. The total of rubber jobs—that's 85 per cent of the town's industrial payroll—has plummeted from the 1936 high of 39,000 to an estimated 26,000. And the end is not yet.

This would be bad enough if it merely bespoke the recession's effects on a city that has always reacted sharply to general trends.

But the fact is that there are 10,000 Akron rubber workers who probably will never find jobs in rubber in Akron again. Akron will make, this year, less than one-third of the nation's tires. The workers are still there but the jobs have moved away.

For this state of affairs, your investigator, after talking to rubber executives, union officials, business men, civic leaders, newspapermen, trolley conductors, and news vendors, has been able to compile a limited list of only 42 contradictory explanations, a few of which are listed below:

1. The CIO has driven the rubber industry out of town.

2. The industry was over-centralized, would have moved anyway.

3. Rubber workers are a backward bunch who run heavily to brawn and are content to farm out their thinking to the irresponsible demagogues who head the unions.

4. Rubber workers are the most progressive group in industry, and their leaders have scored real triumphs by boosting Akron wage scales despite decentralization.

5. Rubber companies operate in a closely concerted conspiracy to defeat collective bargaining.

6. Rubber companies refuse to cooperate with one another on labor problems and therefore make collective bargaining on an industry-wide basis impossible.

7. The unions have consistently bitten Akron in the neck by holding wages up there while failing to organize the industry elsewhere.

8. The union is over-ambitious and is trying to organize the whole industry at once with the result that it is signing contracts outside the city—and, in fact, in the city—at wage scales far below Akron minimums.

Plenty of Opinions

It goes on and on like that. Akron, like every industrially sick city, runs a high temperature. In the third year of the labor crisis, feelings are stronger than ever. Opinions are more plentiful than facts.

On four points there is fairly fundamental agreement. One—labor trouble is the primary cause of the pell-mell exodus of production. Some decentralization was probably inevitable, but it might have been a slow process, resembling erosion, whereas the sit-downs and strikes have given it the force of an explosion.

Two—the companies left the door open to the union, despite high hourly wages, because some of them employed the speed-up unfairly, owing to the sharp competition in which all were involved.

Three—the constant introduction of

* Matters are outwardly worse in Detroit where recent headlines proclaimed 500,000 persons (one in three) on relief. But the Detroit figure was obtained by multiplying each relief and WPA case by five. The Akron figures are based on an estimate of 3 dependents for each relief case and 4.4 for WPA. On the Detroit basis, Akron has 100,000 persons, or one in 2.7 dependent on relief.

• • •

LESSONS

1. **Management reads on Akron's walls a warning of the danger in over-centralization**
2. **Labor—unless it is still spellbound—sees the utter folly of enforcing wage differentials that prevent products of one industrial center from competing favorably with those of others**
3. **Other communities learn that it is never too early to start the job of public relations**

• • •

new machinery has been unsettling to the entire industry.

Four—outside competition in the manufacture of rubber goods played a part in decentralization.

Despite sporadic attempts at organization, as far back as 1912, unionism was not an issue until NRA came along. Then through 1933 and 1934, AFL gained a membership which William Green reported at between 60,000 and 70,000. This fell away, with NRA's demise, until, in 1936, several sitdowns having already occurred, John L. Lewis returned to Akron to preach industrial unionism.* The Goodyear strike followed swiftly. When that ended, CIO's United Rubber Workers of America was firmly on its feet.

Two unique factors made themselves manifest at once. One, Akron

• • •

1929 AKRON

1. Two-thirds of total U. S. tire and tube business

2. High wages — average annual rubber worker's income, $1,662

3. Population, 255,000 — 90 per cent American born

4. 50 per cent of its homes owner occupied

5. Brisk retail trade, both in necessities and luxuries

• • •

the greatest open-shop town in the country, was hopelessly vulnerable to organization just because it *was* so completely centralized. Two, the union's battle for organization was won in the field of propaganda. The townspeople were largely on the side of the strikers. (There, incidentally, is another note on over-centralization. Strictly speaking, the townspeople *were* the strikers.)

When, during a blizzard in February, 1936, the Goodyear strikers threw an 11-mile picket line around the plant and began to build shacks in which to keep their wintry vigil, merchants in the locality "gave" them many thousands of dollars' worth of food and clothing.

The union's clever publicity men cashed in promptly on the public sentiment that already leaned their way. Even if the newspapers had opposed it (which, to say the least, they did not) the union would probably have kept on top through its shrewd and consistent use of radio. Several speakers, such as Sherman Dalrymple, present head of the URWA, took the air almost nightly. Merchants, hotels, newspapers, theaters, and car dealers advertised respectfully in the union publications.

Union's Turn to Boast

Labor Board elections (in August, 1937) went heavily for the union. At Goodyear the vote was 8 to 3, at Goodrich almost 10 to 1. Wage increases failed to check unionization. Fast on the uptake, the organizers simply put the union's stamp on each increase as soon as it was announced.

When, last Fall, the URWA held its second annual congress in Akron, the surface picture was one of lasting industrial peace. It was the union's turn to boast—75,000 members throughout the industry, a year's gain of 50,000; 135 chartered locals in good standing; weekly earnings in all rubber products up 10.1 per cent; dues collections prompt and the 5-cent CIO assessment paid up; Akron's "Big Four" all formally negotiating agreements with the union, still busy; all paying top hourly wages for a 6-hour day. If our story ended there, it would end on a note of victory for the union.

There were cracks in the surface, however. These widened rapidly when Akron's production tumbled. Today, union membership is off 10 to 15 per cent figured on the basis most favorable to organized labor. True, the union denies even now that Akron has been shorn of 10,000 jobs. But, this hardly answers the fact that since 1935:

Goodyear has opened plants at Jackson, Mich., and Windsor, Vt., and has greatly increased production at Cumberland, Md. (the Kelly-Springfield plant), Gadsden, Ala., and Los Angeles.

Firestone has opened plants at Memphis, Tenn. (a former General Motors assembly branch), and Fall River, Mass., and has reputedly increased production at Los Angeles. A subsidiary has purchased a site at Riverview, Mich., near Detroit, for the manufacture of steel automobile rims and the new Firestone rubber bellows air spring for automobiles.

Goodrich is now making tires at its former reclaim plant at Oaks, Pa., and is manufacturing mechanical goods at a plant it purchased about a year ago at Cadillac, Mich.

General, entering the mechanical goods field, went outside Akron to do it, bought a plant at Wabash, Ind.

And there you have an industry that is really on the run! Never has an industry had the unwisdom of over-centralization called so forcibly to its attention,* and never has an industry reacted so promptly. For two big companies, at least, there is no turning back. After the Firestone election this March (which the union won by only 3 to 2), James S. Jackson, the Akron *Beacon-Journal's* astute young labor editor, observed that Firestone's decentralization would have continued even if the "independent" union had won. At Goodyear, there is not even any talk of turning back.

What, then, is Akron's future? Will it, like Paterson, N. J., become another heap of bleached bones on the

• • •

1938 AKRON

1. One-third of the nation's tire and tube production

2. 26,000 rubber workers — with 10,000 rubber jobs gone forever

3. Retail sales off 23 per cent from last year

4. Building permits down 82 per cent from 1937 figures

5. 70,000 people dependent on some form of relief

• • •

industrial trail, another awesome warning to centralized industries?

Well, there's hope for Akron. In fact, two rays of hope now shine through the clouds of gloom that envelop the city. These are:

1. Akron may yet succeed in attracting some *new* industries.

2. Public opinion has swung away from its once complete support of the union's most aggressive tactics.

Consider first the Greater Akron Association. It was formed two years ago. About 80 business firms, including the rubber companies, chipped in to get it going. Its aims were (1) to seek new industries, (2) to make decentralization unnecessary, (3) to promote interest in local government,

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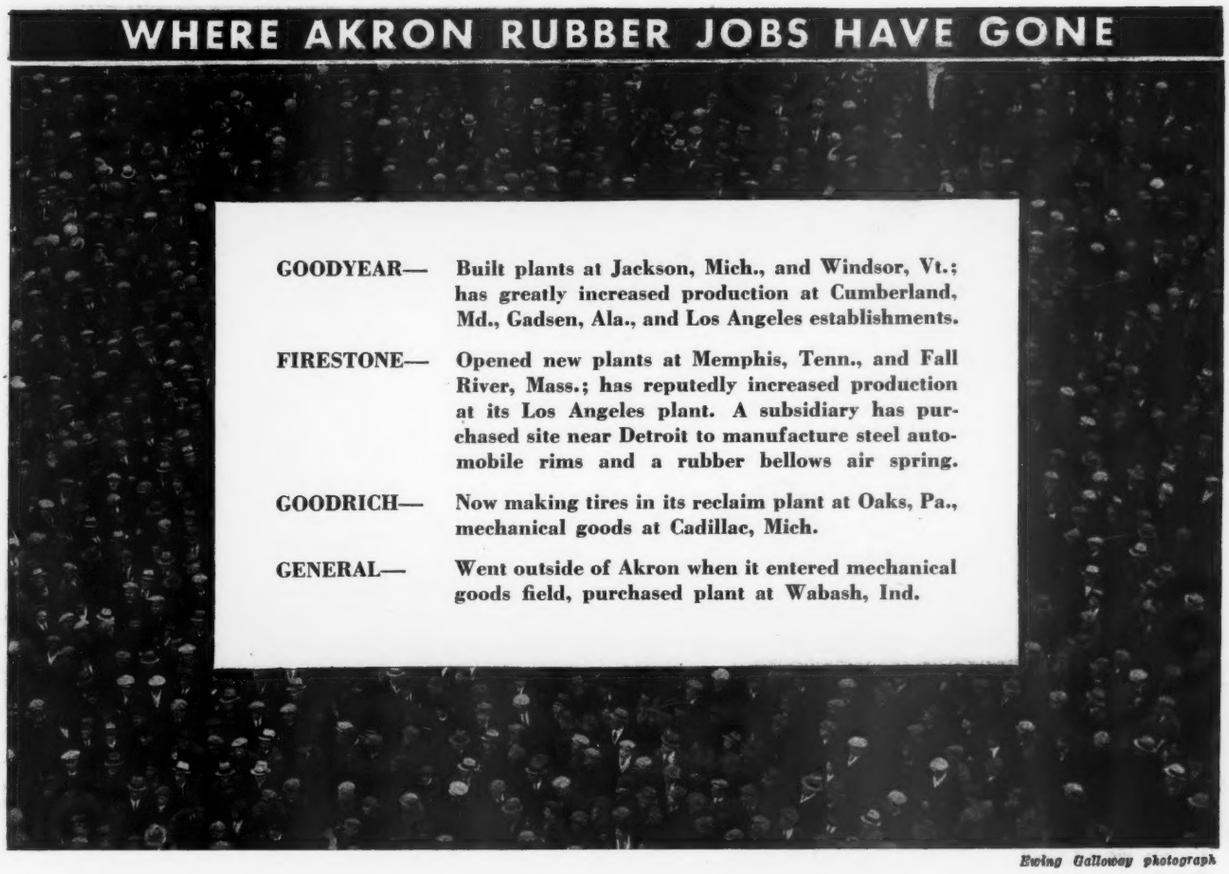
* Lewis had been there once before; he made an unsuccessful attempt in 1913 to organize the industry for AFL.

* A most urgent attention-caller was the automotive industry. "Customers have let it be known," said one rubber executive, "that we had better establish plants outside Akron if we expect to enjoy our full share of the business." It is noteworthy that Ford Motor Company has begun to make its own tires.


WHERE AKRON RUBBER JOBS HAVE GONE
GOODYEAR— Built plants at Jackson, Mich., and Windsor, Vt.; has greatly increased production at Cumberland, Md., Gadsen, Ala., and Los Angeles establishments.
FIRESTONE— Opened new plants at Memphis, Tenn., and Fall River, Mass.; has reputedly increased production at its Los Angeles plant. A subsidiary has purchased site near Detroit to manufacture steel automobile rims and a rubber bellows air spring.
GOODRICH— Now making tires in its reclaim plant at Oaks, Pa., mechanical goods at Cadillac, Mich.
GENERAL— Went outside of Akron when it entered mechanical goods field, purchased plant at Wabash, Ind.

Ewing Galloway photograph

and (4) to coordinate the activities of existing civic organizations.

The Association launched its program in July, 1936, with a series of local newspaper advertisements which pointed out that there was no city in the world where workers were paid as well by the hour, week, or year, as they were in Akron, and urged that every rubber worker and every citizen join in preserving this extraordinarily favorable position. Members of the Association's executive committee and staff and leading citizens of Akron took to the radio to present its program in detail.

The Association later published an analysis of Akron's attractions for new industry, distributing several thousand copies of a booklet entitled "Put Your Plant in Akron." This set forth Akron's many real advantages—its central location; its excellent water, natural gas, power, and terminal facilities; its exceptionally low tax rate. Periodically, likeable young Byron H. Larabee, who had become the Association's Executive Secretary in December, 1936, went places to see people about moving their plants to Akron.

His task would not have been easy under any conditions. When a town like Akron sets its cap for new industries, it has to compete with the blandishments of cities which offer free plant sites, tax exemptions, low labor costs, and even cash.

Periodically, Larabee reported his progress to the townspeople, via radio. He explained frankly that he wasn't making any progress and told why. Everywhere he went, he had to explain away the sitdown strikes. Every time he got anybody interested in moving to Akron, another sitdown broke out.

The Picture on the Front Page

Larabee was especially bedeviled by a front-page picture of a band of Akron rubber unionists, flourishing clubs, en route to Youngstown to join in the picketing of "Little Steel."

Until then he had been hopeful in all his public utterances. On June 8, last year, he reaffirmed his faith in collective bargaining, voiced a new plea for peace and declared:

"We believe that it will not be long before other cities will say—'Look at Akron. They worked things out. They found out how to go ahead.'"

There was a time, later that month, when Akron seemed about to be bathed in sweetness and sunshine. URWA officials offered their cooperation in the Association's campaign. Cried Mr. Larabee, delighted:

"When to new industry we can give assurances that our workers as well as our business men will welcome them in a spirit of mutual helpfulness, Akron will have no difficulty in securing a substantial number of new payrolls."

Then came the pictures of the Youngstown junket. The Greater Akron Association took its sights off the birds in the bushes and devoted itself to the squirming birds in hand. True, it continued its advertisements to the outside public. But to the home folks it talked cold turkey as no civic association has ever talked before. Earlier it had kept within the limits of such slogans as "The Best Wage Rates in the United States." Now it based its advertising appeals on an outright citation of the damage already done.

"The trouble is the same old trouble," Larabee declared, "the unwillingness of various union leaders to show a reasonable attitude of cooperation with respect to the problems of these various companies."

This inevitably led him into conflict with the union leaders. Soon all talk of cooperation was forgotten. At least once a week for quite a spell, he

When General went into the mechanical goods business, it passed up Akron for Wabash, Indiana

traded punches over the radio with the union's best talkers. Without emotional embroidery he patiently repeated his facts and figures.

Right Time to Cry

"There is a time to cry over spilt milk—it's while there is some of it left," he declared. "That time has arrived."

Ultimately the campaign began to tell. Through the early fall of 1937, production held up well in Akron rubber. Then, as it slackened, public sentiment shifted perceptibly. This was reflected in the city elections which found Mayor Lee D. Schroy, Republican incumbent, pitted against former Judge Garnett L. Patterson, a personable, dynamic New Dealer with plenty of microphone presence. Patterson had full union backing in a whirlwind campaign. Schroy methodically hammered at the theme that industries provide jobs, and that jobs exist where industries prosper.

Schroy won by 8,000 votes, which meant that many rubber workers who voted for CIO in Labor Board elections had voted against it politically. The tide was turning. And when, in December, the Greater Akron Association declared: "The effects of decentralization are just beginning to be felt," people were ready to listen.

It was plain at the turn of the year that the lull in Akron's labor strife was merely an intermission between acts. Another decisive episode began in late February when the news spotlight paused over the 125-acre plant where Goodrich makes 32,000 different products in 116 different factory buildings.

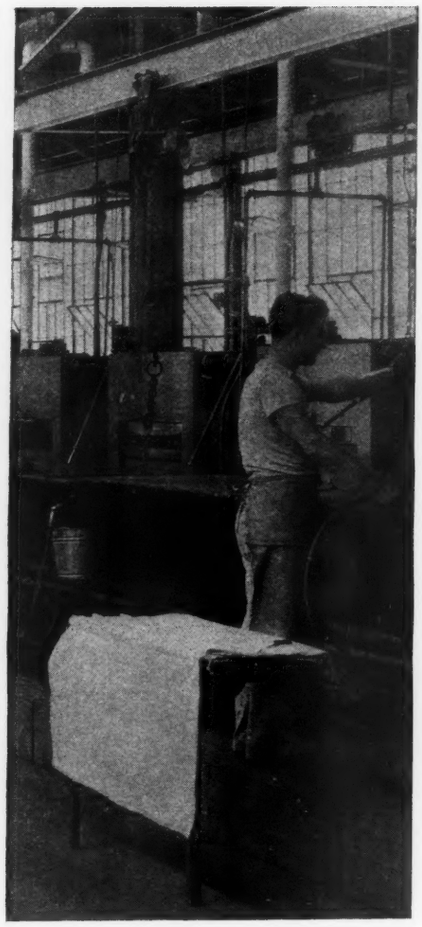
Goodrich had shown, from the start, a determination to deal directly with the elected representatives of its people. This may be one reason why Goodrich has never suffered a prolonged strike, nor has it been put to the expense of building new plants, save for its expanded operations at Oaks, Cadillac, and Los Angeles. Goodrich had humanitarian reasons for not wanting to move. Sixty per cent of its men have been with the company 10 years or more, 50 per cent participate in the Goodrich retirement fund, 50 per cent own their own homes.

However, Goodrich, like the other companies, had learned that unskilled workers outside Akron could be trained for rubber work in fairly short order. And Goodrich, still producing two-thirds of its tires in Akron, was finding an increasingly serious problem in the wage differentials which decentralization produced.

In 1936 Goodyear was the biggest Akron employer (14,054), Goodrich was second (11,200), and Firestone third (8,443). By January, 1938, the balance had shifted. Goodrich led (10,568), decentralizing Goodyear was second (9,255), and Firestone was a still lower third (7,440).

Welcome on the Mat

Obviously the wage differential was forcing action. Innumerable cities were ready to welcome new Goodrich plants, which would take an estimated 5,000 jobs out of Akron. In February the company, breaking precedent, put the following requests before the union—an hourly wage reduction



from $1.10–$1.15 to 90–95 cents, for men, and from 70–75 cents to 60–65 cents for women; assurance that machines would be operated efficiently; and a flexible six to eight hour day. Otherwise, said the company, it would be forced, by its competitive position, to take decentralization steps.

Union leaders agreed to put the proposal to a secret vote on March 14, 15, and 16, but the vote, at the last minute, was canceled. Akron seethed with excitement. Automobiles bore windshield stickers with the slogan, "Keep Goodrich in Akron." Union heads hurried to Washington where they persuaded a congressman to introduce a bill designed to block further decentralization. This got nowhere. Back in Akron, Mayor Schroy demanded that the Goodrich workers vote on the proposal. The union leaders and the Mayor exchanged acrimonious remarks. All this, dragging on through the weeks, heightened the tension to the breaking point.

On April 11, Goodrich withdrew its proposal. Then up came James P. Miller, Regional Labor Board Director, with an unofficial 15-point peace proposal. This cleared the air temporarily and negotiations staggered forward again. Meanwhile, at Miller's request, A. F. Hinrichs, chief economist of the Labor Department's Bureau of Statistics, began a study* of labor costs and wage differentials on which an agreement was to have been based.

The union heads, fearful of waning public support, but fearful also that other companies would force wage reductions if they gave in to Goodrich, made a counterproposal of a 6 per cent wage reduction, but it was festooned with qualifications, including a demand for a two-year guarantee against further decentralization. This the company promptly rejected.

Voted by Show of Hands

Seeing no hope of drastic government intervention, the unionists at length agreed to vote on the original Goodrich proposal. The election was held May 4. But what an election! The vote was taken by a show of hands at five separate meetings. Opponents of the proposal jammed the first meeting and howled and hissed at those who voted "Yes." The final score was 2,251 for rejection, 239 for acceptance. Thus 2,490 Goodrich workers decided the fate of 9,000 Goodrich workers.

While businessmen in the town growled openly and talked of forcing the Goodrich union to hold a secret ballot, the spotlight swung to Firestone. Here negotiations were under way to renew the contract that had expired on April 28. On May 16 Firestone officials and union heads put their signatures on a signed agreement confirming existing wages, hours, and conditions in the Firestone Akron plant.

This was not as significant as it sounded, for Firestone had by then transferred two-thirds of its tire production to outside plants. Nevertheless, it gave the Goodrich union ground for an aggressive new move. It renewed its demands for a signed contract. Goodrich was not averse to signing a contract; had, in fact, ready for signature, a contract that had been negotiated some months before. A brief strike broke out. The union called it a "labor holiday." When it was over, Goodrich had signed an agreement which confirmed wages at their existing levels. The company gained slight concessions on paid vacations and the flexible work week. With peace once more established at Goodrich, the spotlight shifted again.

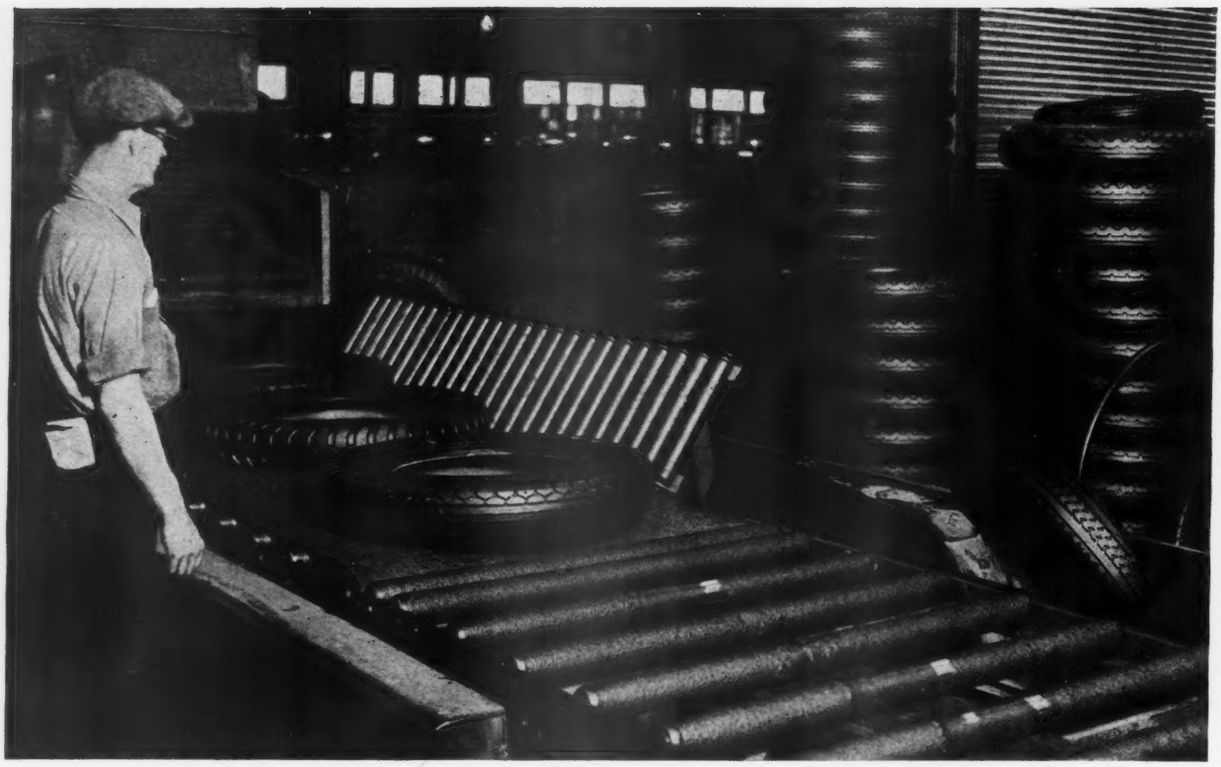
Goodyear this time. Here was the last of the "Big Four" not under contract. Into the meetings where contract negotiations were going slowly forward, the union leaders brought a heap of new grievances, including several recently posted wage reductions. The Goodyear local laid a strike ultimatum before the management on May 25. Tension increased again. The company made preparations to move some of its office equipment and records from the plant to a downtown office building. The union inserted notices in the papers, urging citizens to keep their radios tuned for an "important announcement." This obviously referred to a strike call but no strike had been called when Akron's worst strike riot broke out.

Shortly before midnight on May 26 a large crowd gathered outside the Goodyear plant. The crowd was at first good-natured, and so were the police. But the undertones were ominous. Inside the plant, fifteen trucks stood with motors running The crowd refused to back away from the gates. Finally, company guards pushed the trucks through despite efforts to stop them. This safely over, it seemed that the incident might pass peacefully, after all, even when the midnight shift came off work and joined the crowd. But inevitably, the spark and the powder keg got together. Somebody socked a cop or a cop socked somebody, depending on whose version you accept. Anyway, there were riot calls for two pitched battles involving 160 policemen and over 3,000 men and women. When it was over, there were 75 people in the hospital, including a bystander, who caught a trianguar slug of metal in his back, and a cop whose face stopped a charge of shot from a pump-gun.

Promise of Violence

Next day, though the first shifts were relatively full, the strike became a reality. The odor of tear gas, which still seeped through shattered windows in the vicinity of the Goodyear plant, seemed the promise of more violence to come. The company announced that the plant would reopen on the Tuesday following the Decoration Day week-end, and the union said flatly that it would not. Mass meetings were held all through the week-end. Mayor Schroy charged the union with inciting to riot. The

* Which proved, on arrival, to be a non-committal document that settled no questions.



For every two tires that rolled off Akron's conveyors in 1929, there is only one today

union, retorting that the Mayor was a stooge, threatened a city-wide labor tie-up.

Peacemaker Miller of the Labor Board perspired mightily in his efforts to bring union and company officials together again and at the last moment succeeded. On Monday night the strike was called off, the union announcing that the company had promised to sign a contract. The company later denied this, saying it had merely promised to consider the discussion of a contract at some future time. Negotiations were resumed as the strikers went peacefully back to work on Tuesday morning. The strike was over, perhaps an omen that there will be less irresponsible action in the future.

No one can say at the time of writing whether there will be a signed agreement or another strike at Goodyear. At best, the prospect is far from pleasing for the fellow who wants to sell shirts, socks, washing machines, and automobiles* in Akron, for further decentralization seems inevitable. A new strike would, of course, make matters immeasurably worse. On both hands it is freely predicted that another Goodyear strike would be a very serious business with the possibility of National Guardsmen being drawn into the picture.

In the bitter end, further decentralization may prove to be a good thing for Akron in the sense that the Chicago fire was a good thing for Chicago. Akron has the spirit to rebuild its industrial structure along diversified lines, but it remains to be seen whether its industrial relations program can take effect in time to save it from the utter collapse that shattered the over-centralized textile cities of the East. In any case, the city is due to get a lot thinner before it gets fatter. And then, ironically, it may be that a surplus of labor, resulting from rubber unemployment, will help to attract new industries.

Branch-Plant Town

New struggles, outwardly more spectacular, loom in the near future, but history will probably record that the crucial battle to keep Akron from becoming a branch-plant town was lost when the union turned down the Goodrich proposal.

Here the CIO blocked a reduction which, if accepted, would have left Akron wages at an average of 95 cents an hour, substantially above those in other cities and industries. Akron executives have charged that the local unionists took their orders from the CIO high command in Washington. Certainly the Lewis group had reason to fear that acceptance of the Goodrich proposal might have been interpreted as a blow to national CIO prestige. Critics of the CIO insist that the union sacrificed Akron to preserve this prestige.

This charge would be much easier for the union to answer if the Goodrich proposal had been voted upon democratically by a majority of the Goodrich workers. But this, under the Wagner Act, was impossible. The Union, under the Act, was in a position to insist that only the dues-paid members—only 2,500 out of 9,000—could vote on the proposal. The company, bound by Wagner Act restrictions, was unable to discuss the question directly with the 6,500 non-dues-payers. And the 6,500, having once signed away their rights to the CIO, were helpless to express themselves in the crisis.

Other such minority decisions, affecting the whole future of the labor movement and the welfare of industry in its entirety, may be expected until the law is changed to make the secret ballot available to management as well as labor. Meanwhile Akron survives as a tumble-down monument to a succession of union triumphs which have cost it 10,000 jobs and may cost it more—a city which bears testimony to the maxim that everybody loses in a labor war.

* New-car sales in Akron are 74.4 per cent below 1937 figures for the period from January through May.

Tell Us What You Have Done to Cut Costs

Factory invites you to a cost-cutting clinic. You chip in an idea. So do a lot of other plant operating men. Factory publishes them. You use the other fellow's. He uses yours. Everybody profits

SOMEBODY who reads *Factory* is going to be $100 richer shortly after August 15. Two other readers are going to get checks for $50 and $25 respectively. And 50 more will be paid $5 or $10 apiece for the best cost-cutting ideas submitted in competition for the *Factory Awards* announced in May and June.

Not only that, but *Factory* is also going to pay regular rates for all other ideas that the judges consider good enough to publish.

Why? Well, it's your job to cut costs. Ours to help you. Here's how we propose to do it. You tell us about one or more of the cost-cutting ideas you have used successfully in your plant. And a lot of other plant operating men do the same. We publish them. Then your idea goes to work for some other fellow, either "as is" or slightly modified to fit his special conditions. Some other fellow's idea goes to work for you.

Get More Than You Give

It's that simple. Fact is, we shall be ever so surprised if a dozen other fellows' ideas don't go to work for you. That's how this business of swapping ideas works out. You get more than you give.

But of course what you want to know is what do we mean by cost-cutting ideas. That's easy. We could begin with *air conditioning* and go right on down through the alphabet. For instance, an electrical manufacturer was having trouble with white molded plastic parts. A speck of dust stood out on them like a sore thumb. He couldn't air condition the whole works. But it was relatively inexpensive to partition off a few square feet and condition that much. The rejects are few and far between today.

Or take *buildings*. One company uses a specially designed spring bumper on swinging doors. It saves wear and tear and time and tempers. The men who have to drive tractors and trailers through them no longer have to climb down and hook the doors back.

Cafeterias? Sure. There's the company—but come to think of it that story is coming up in August. Anyway, all we aimed to do was give you a rough idea. If you need more samples, turn to page 96 and read the "Operating Shorts."

To help you further, there is appended a list of suitable subjects. Look through it and see if something doesn't occur to you. There are scores of cost-cutting ideas in every plant. They are your ideas. You know what they've saved, how they've improved quality, or made your plant a better place to work in. Why not tell us about them?

You have till August 15. *But enter your name now.* There's a reason. We still have a limited supply of "Factory's Checkbook for Greater Profits" and will send them out as long as they last to those who signify their intention of submitting a cost-cutting idea. You'll find it useful. It may help you make money for your plant. And it may recall something you've done that will make a good "Short" to send in. Somebody is going to get $100. Why not you?

SUGGESTED SUBJECTS FOR SHORTS

Air Conditioning
Apprentice Training
Buildings
Cafeterias
Cleaning
Cost Control
Dust Control
Electric Heat
Electrical Protection
Employee Relations
Employee Selection
Fire Protection
Floors
Foreman Training
Heating
Inventory Control
Instruments
Layout
Lighting
Lubrication
Maintenance
Organization
Materials Handling
Mechanical Power
Transmission
Motion Economy
Motor Controls
Motors
Painting
Policy
Power Factor
Production Control
Public Relations
Quality Control
Roofs
Safety
Signaling
Sanitation
Time Study
Transformers
Wage Payment
Walls
Waste Elimination
Welding
Wiring

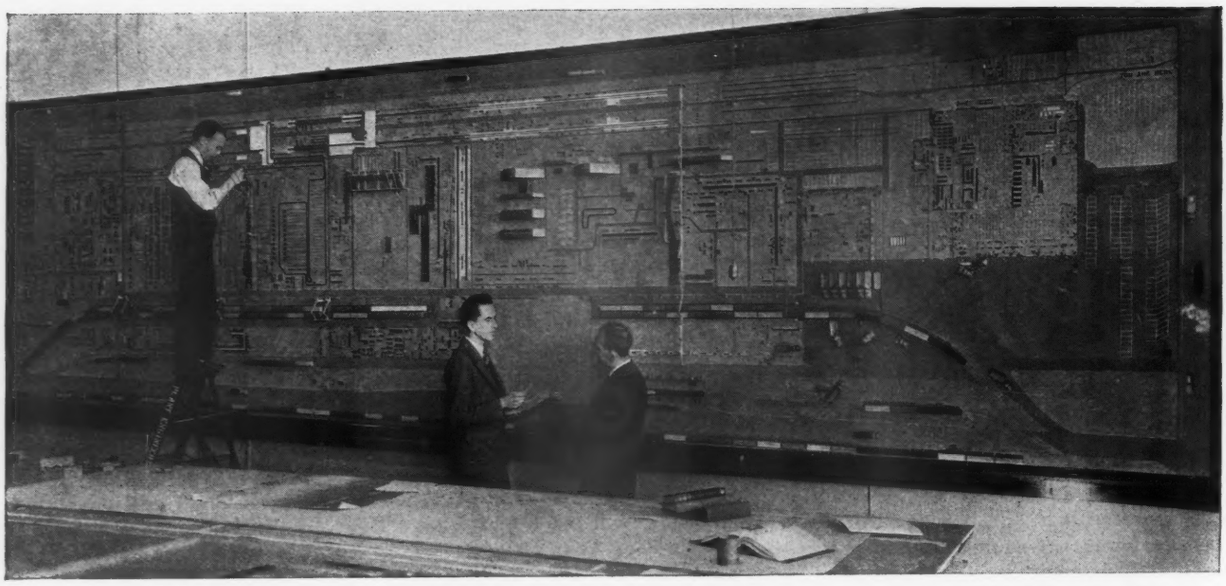
RULES

1. You can enter a cost-cutting idea in competition for the *Factory Awards* if you are regularly employed in the manufacturing industries. You don't have to be a subscriber to *Factory*. Your idea may be as short as you care to make it. But it must not exceed 300 words. Send in more than one if you like.

2. Remember the old Chinese proverb: One picture's as good as 10,000 words. If you have a photograph or a drawing that helps to make your idea clearer, let's have it. But a picture is not essential.

3. Mail contributions not later than August 15, 1938, to L. C. Morrow, Editor, *Factory*, 330 West 42d St., New York, N. Y. Winners of the *Factory Awards* will be announced in an early issue thereafter. Duplicate prizes in case of ties. Judges: L. C. Morrow, Editor; L. K. Urquhart and G. A. Van Brunt, Associate Editors.

4. All material submitted at sender's risk. The editors reserve the right to publish prize-winning ideas, also other ideas accepted and paid for at regular rates.



Even drinking fountains are shown on the big board where Plymouth lays out to scale its 1,110,620 sq.ft. of plant

Plant at a Glance

Layout changes can be made in double-quick time if plant is on wall for all to see. And time is of the essence when model changes confront the plant engineering department

CHARLES C. WILLIAMS

Plant Engineer, Plymouth Motor Corporation
Detroit

TWENTY YEARS AGO, when a change in product or process was contemplated, the manager would call in the department head to discuss how the change was to be fitted into the existing plant. Invariably the reply was that a new building would have to be erected to house the new operations.

All too frequently the result, from the standpoint of economy in manufacturing, was a collection of small and poorly related buildings. Even more recently, poor layouts and excess space in manufacturing departments have resulted where requirements were LOT carefully considered by a central plant engineering department.

Plant engineering activities at the Plymouth Motor Corporation are centered around the big board shown in the illustration at the top of the page. On it the 1,110,620 sq.ft. of space in the Plymouth plant is reduced to an area 29x8 ft. in size, and every detail is shown to exact scale. Detailed layouts, once decided upon, are thus recorded in permanent form.

In the first place, we wanted to be able to visualize the entire plant. The big-scale model permits this. Then, if some department head has an idea for changing his own layout, it can be seen at once how this proposed change will affect adjacent departments and how it will affect the movement of materials between departments.

The board, being to scale, permits measurements to be taken from it without the necessity of taking a tape out into the shop. This is a time-saving feature for the four engineers who have to make the necessary adjustments when a process is changed.

It may be observed that a drawing to scale would also be accurate, and so it is—but it is impossible to get a conception of departmental relationships as easily and accurately as with such a board. It must be remembered also that any change affects several people; the foreman, the superintendent, the factory manager, and frequently the major officials of

the company must be convinced and satisfied. This board permits any number to assemble in front of it for conference with details visible to all.

One use, not at first thought of, developed quickly when the board was completed. The many visitors to the plant are now brought here first to have the nature of the material flow through the plant explained to them.

The board is made in sections, on a double thickness of wall board supported by vertical battens at the back. It is painted with a base coat of enamel, and this is in turn covered with a washable paint, the color being varied to differentiate the various factory departments.

Red for Ovens

Upon the base colors are tacked templets of $\frac{1}{8}$-in. white pine, again according to a color scheme. Yellow indicates stock bins; green, benches; red, ovens; blue, tanks; black and brown, machines. Colors are alternated between departments for readier visualization.

Floor conveyors are shown by a black band. Roller conveyors have a cream band. Even drinking fountains are shown, by a white button. Aisles are painted a gray water color edged with a narrow white stripe.

Machine templets are merely flat pieces of pine, each cut to scale. Ovens that require considerable headroom are represented to scale both vertically and horizontally. A scale section of the roof truss is added, showing how a vertical piece of apparatus, such as an oven, may best be fitted into the building.

Conveyors Are There, Too

Overhead chain conveyors run through the plant in a maze of ascending and descending sections; at one point dipping to within a few feet of the floor for convenience in loading or unloading, or running up into the roof structure to avoid an aisle way.

These are indicated, in all their twists and turns, by wire strands placed about an inch above the board. Fishhook shanks, pointed for ease in pushing into the board, are used to carry this wire.

In the automobile industry, even between the yearly change in models, an engineering change at any time may involve plant modification to accommodate it.

Since the plant engineer is the last in the string of executives concerned in such a change before it gets into actual production, he must always function under considerable pressure for speed. When I say that our time allowance varies from one week to as high as a month for a major model change, it can readily be appreciated how important such a board is in conserving the time of plant engineers.

The master mechanic passes along a corrected operation sheet, with the machines indicated. If new machines are to be installed, a print must be secured to furnish the over-all dimensions. If old machines only are involved, we have templets already available.

To one of our four engineers is assigned the job of providing plant facilities. Of course, more than one may be concerned, for these men are specialists; one looks after heating and ventilating details, another construction, another conveyors.

A Permanent Record

A drawing of the department concerned is tacked to a board and placed on saw horses immediately in front of the big board. Paper templets are used to establish the flow, and the board is used for necessary measurements and for illustrating how the proposed change will affect other departments.

When completed, the approved change is transferred to the big board as a permanent record. A drawing is made for the maintenance superintendent, and he must make an estimate of cost as a basis for the covering appropriation.

For the layouts of our branch plants in Evansville and Los Angeles, a three-faced board is provided. This apparatus is 12 ft. 6 in. long, and each of the three sides is 4 ft. in width. At each end it is supported on trunnions which permits tilting every 30 degrees, for convenience in working on it. The whole affair is 48 in. high.

Special advantage of this arrangement is the space-saving characteristic. With only 1,635 sq. ft. available for plant engineering work, this is an important feature.

A duplicate of the big board has now been installed at the Harvard School of Business Administration, where it is used in conjunction with operation sheets to teach layout and flow of work in quantity-production manufacturing.

Important space-saver, this three-sided layout board on which Plymouth engineers show Evansville and Los Angeles assembly plants. It's supported on trunnions, is quickly shifted into convenient position

The Folks Dropped In

Western Electric employees wanted to show their families and friends what sort of place they worked in. So another company joins the long list of industrial concerns that find the "open house" one of the simpler ways to "sell" the public

Itinerary included manufacture of telephone cable and handset telephones from start to finish. In spite of having 5,000 people a night peering over their shoulders, the girls on the assembly line (top) met quotas

Visitors learn (center) that the packers' boast is rivaled by Western Electric's economies in copper rod manufacture, when even the oxide removed in pickling is reclaimed

Progressive dies may have been too much for the friends at the left. But out of their evening they took away a better understanding of what "big industry"—particularly Western Electric—means to American life

Seventh I.M.C. Here in September

FOR the first time the International Management Congress is to be held in the United States. The dates are September 19 to 23, 1938. Place, Washington, D. C.

This is the seventh congress of its kind. Begun in 1924 in Prague, subsequent meetings have been held in Brussels, Rome, Paris, Amsterdam, and London.

American industry will have a peculiar interest in this first Congress held in America. It comes at a time when American industrial management literally is "on the spot." Both government and labor are questioning its position in the social structure.

What are management's responsibilities to society? What is the influence of technical progress upon social development? What must be done to fit our distribution methods to the modern economy? How can incentive and security be balanced? How can free enterprise be continued? What are labor's aims and responsibilities? What are management's aims and responsibilities? What is the public's concern in industrial harmony?

Leaders of thought and action in America will attempt to answer these and other questions at the eight general sessions partially outlined in the accompanying program. Speakers from European countries will present their views on similar subjects.

Four Main Objectives

The congress program is built around these four objectives:

1. Provide a forum for interchanging world experience in all phases of management, thereby aiding the economical production and distribution of goods and services in industry and agriculture, and increasing the satisfaction of using the resultant benefits in the home.

2. Give management in industry and agriculture a needed opportunity to appraise the social and economic results of its work, and discern its future course under rapidly changing conditions and new concepts of its responsibility.

3. Give leaders of thought and action the opportunity to advise management in its relations with the public, labor, and government.

4. Give management an opportunity to re-dedicate itself publicly to the principles and practices that are easing daily labors, spreading the advantages of widely distributed goods, promoting the well-being of the peoples of the earth.

Administration, production, distribution, and personnel are the four subjects in which industrial management will center its technical interest at daily sectional meetings. Approximately 200 papers have been prepared by American and European authors. Discussions will be based on the 200 papers which will have been printed and distributed in advance to registrants. Anyone may register for attendance, but must have paid the $10 registration fee in advance in order to receive copies of the papers.

The sponsoring group is the International Committee of Scientific Management, a federation of national groups in some seventeen countries. The American affiliate of the international committee is the National Management Council, composed of representatives from American societies making the advancement of management their major function.

INTERNATIONAL MANAGEMENT CONGRESS

PARTIAL PROGRAM FOR GENERAL SESSIONS

Management's Responsibilities to Society
A. W. ROBERTSON
Chairman, Westinghouse Electric & Manufacturing Co.

Influence of Technical Progress upon Social Development
DR. KARL T. COMPTON
President, Massachusetts Institute of Technology

The Social Aspects of Nationalization
G. SEEBAUER
Director, Reichskuratorium für Wirtschaftlichkeit

Reshaping Distribution to Modern Economy
OSWALD W. KNAUTH
President, Associated Dry Goods Corporation of N. Y.

Coordination of Production and Distribution
Speaker from Sweden, to be announced

The Balancing of Incentive and Security
RALPH E. FLANDERS
President, Jones & Lamson Machine Company

Employee Security as a Responsibility of the State
GINO OLIVETTI
Chairman, Ente Nazionale Italiano per l'Organizzazione Scientifica

Psychological Foundations of Management
DR. HENRY C. LINK
Director, Psychological Corporation

Human Aspects of Management
MAURICE PONTHIERE
Directeur de l'Ecole Organisation Scientifique du Travail de Paris

The Continuance of Free Enterprise
W. J. CAMERON
Ford Motor Company

The Continuance of Free Enterprise
DR. A. BASCH
General Manager, United Chemical and Metallurgical Work, Prague

Labor's Aims and Responsibilities
ROBERT WATT
American Workers Delegate to International Labour Organization

Management's Aims and Responsibilities
LEWIS H. BROWN
President, Johns-Manville Corporation

The Public's Concern in Industrial Harmony
WILLIAM ALLEN WHITE
Editor, The Emporia Gazette

The Machinery of Industrial Conciliation and Arbitration
Speaker from England, to be announced

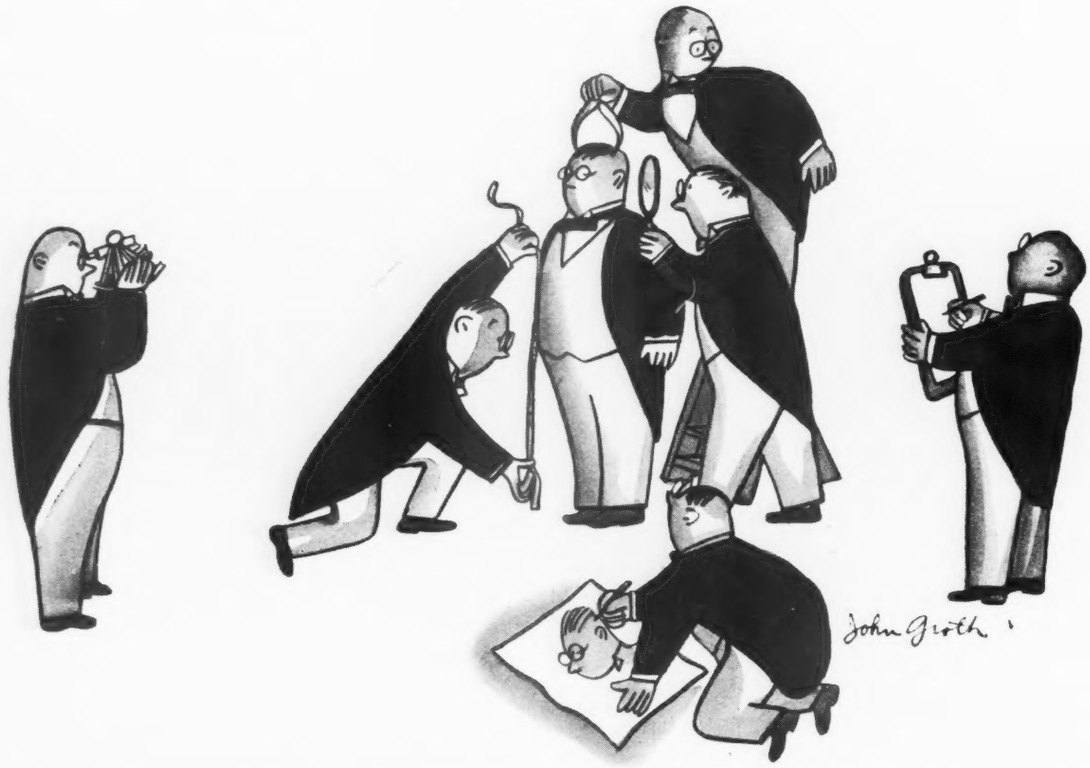
International Cooperation in Management
TH. LIMPBERG
Professor of Business Economics, University of Amsterdam

Social and Economic Aspects of Management
Speaker from International Labour Office, to be announced

Matching Executive Traits and Abilities

How fifteen executives agreed upon twelve desirable traits. How each of the fifteen rated all the others. And the extent to which each trait was found to accompany executive ability in the group

ARTHUR F. DODGE
Assistant Professor of Industrial Education
University of Illinois



THIS ARTICLE reports the results of a careful study of the traits possessed by a group of department heads of a large organization. The number of the group was small, fifteen, but other conditions under which the experiment was carried on were unusually favorable so that it is believed the results are worthy of consideration.

During a series of conferences with this group of department heads, carried on under my leadership, the question of what traits are desirable in an executive came up for discussion. After considerable argument, twelve traits were agreed upon. It was then that one of the department heads proposed that each member of the group rate every other member on each of these traits in order that each might obtain an impersonal opinion as to his standing in each trait.

Arrangements were finally agreed upon whereby ratings were to be made anonymously, to be tabulated later by me, and a report made privately to each member showing the ratings he received in each trait and his position with respect to ratings for the whole group. I agreed that the individual ratings would be held strictly confidential.

Considerable care was taken in setting up the rating scale and in planning methods of making the ratings. It was agreed, for example,

TABLE I

CORRELATION BETWEEN TRAIT RATINGS AND RATINGS FOR EXECUTIVE ABILITY

Trait	*Coefficient of Correlation*
Personal Appearance	+.66
Intelligence	+.61
Willingness to Assume Responsibility	+.59
Self-Control	+.49
Broadmindedness	+.46
Decisiveness	+.44
Tact	+.43
Reliability	+.41
Cooperativeness	+.41
Interest in Others	+.33
Sincerity	+.30
Sense of Humor	+.11

Table II. Rating Instructions

Indicate your opinion of the strength of each trait by writing "1" to indicate a very low rating and "5" to indicate a very high rating. Intermediate ratings may be indicated by "2," "3," or "4," as indicated below. Experiments have proved that ratings are more reliable when the rater considers one trait at a time, rating all individuals on that trait before passing to the consideration of the next trait.

	1 Low	*2 Below Average*	*3 Average*	*4 Above Average*	*5 High*
Cooperativeness	Never inconveniences himself to help others				Always willing to subordinate himself or his department for the good of the whole organization
Sense of Humor	Sees nothing but the serious side of life				Can enjoy a joke on himself
Intelligence	Faced with unusual situations, his solutions are usually "full of holes"				Sees clearly and quickly the proper solution for new and difficult situations
Self-Control	Loses temper at least provocation				Always even tempered, even under provocation
Broadmindedness	Has fixed ideas and opinions; has no patience with those who disagree				Tolerant of the opinion of others; always willing to listen to adverse criticism
Willingness to Assume Responsibility	Always insists on consulting his boss even on minor problems				Does not hesitate to make decisions unless clearly outside of his authority
Decisiveness	Always defers decisions as long as possible				Faced with a problem he demands immediately all pertinent information and makes a decision at once
Appearance	Untidy both in clothes and physical appearance				Always well dressed, but not *over* dressed
Tact	Constantly irritates others by his words and actions				Can "call down" a subordinate or criticize plans of superior without leaving feeling of resentment
Interest in Others	Appears inattentive or even annoyed when others are telling him their experiences or problems				Always seems to be glad to talk with others about their experiences and problems
Reliability	Never can be depended upon; has to be followed up constantly to be sure promises are carried out				Whenever he promises to do a thing you know you can forget about it as you are sure it will be done
Sincerity	Often pretends feelings and opinions he does not have				One never doubts the reality of the feelings and opinions he expresses

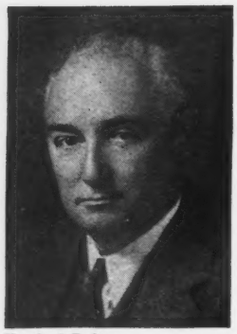
to rate the whole group on one trait at a time, and the results seem to indicate that the pooled results of the ratings are rather reliable measures of the traits. There was rather close agreement on the ratings. Also there seemed to be very little "halo" effect; many instances occurred where an individual was rated at the top on one trait but near the bottom on another.

After these trait ratings were obtained, it occurred to me that here was an opportunity to discover what relation existed between executive ability and possession of these various traits, provided it were possible to obtain some measure of executive ability. This was obtained from ratings on executive ability by the division manager to whom all these department heads reported.

Table I indicates the extent to which each of the traits was found to accompany executive ability in this group. The traits listed toward the top of the table tend to be possessed to an unusual degree by the men who were rated high in executive ability and to a lesser degree by those rated low in executive ability. Those listed toward the bottom of the table were possessed to almost as high a degree by the low-rated executives as by those with high ratings.

I was rather surprised at the relatively high correlation between personal appearance and executive ability. Is personal appearance an important factor contributing to success as an executive? Was the division manager unduly influenced by personal appearance in making his ratings for executive ability? Or was this relation between personal appearance and executive ability purely a matter of chance? Sense of humor at the bottom of the list was another surprise because this trait has been stressed by many writers as an important element in executive ability.

Table II shows the instructions handed out at the time the trait ratings were made, and indicates the basis on which the ratings were made.



Harris & Ewing

It's This Way in Washington

No extra session on the horizon — plight of the railroads and Congress's failure to come a-running — big party purge now on — Lewis kicked a third time, as usual where it hurts

CARTER FIELD
Washington Correspondent

DESPITE all the weeping about the failure of Congress, before adjournment, to pass any legislation to help the railroads, and various other complaints about things left undone, there is little real probability of an extra session. If it is called, it will be because of some big new development, such as war in Europe.

Actually no large group of persons is really anxious for railroad legislation. A good many things might be done for the railroads, but, as many influential railroad men see the situation, none of them *will* be.

As these pessimists see the picture, all any legislation would permit them to do would be to go farther into debt. There is no proposal, for instance, to take the crushing burden of taxation off their backs. There is no proposal to permit them to operate economically, either by using fewer men by short-circuiting various laws and union rules of the full-crew variety, or by discontinuing useless lines.

No one has even suggested that the railroads be permitted to fix their own rates for a while, with the privilege of offering bargain-counter terms occasionally to get business, without being forced to maintain that particular "sale" indefinitely.

During these same closing months of the session just ended there was plenty of interest in TVA, and even since Congress adjourned there have been loud political screams from some of the Southern legislators, to the general effect that the South was discriminated against in freight rates.

Meanwhile the government pushes ahead with its development of the Tennessee river, claiming that wonders will be wrought by the cheap movement of freight over this highway. In fact, the government is encouraging the idea of moving refrigerated freight which usually goes by fast express in refrigerator cars, such as strawberries, by the river instead of by rail.

All of which may or may not be sound. But the fact remains that the railroads in this particular section are if anything a little bit harder hit than those in most of the country.

A great many conservative-minded officials and legislators believe that the present drift is straight toward government ownership of the railroads. This is why so little live steam was turned on to put the railroad bills through. This, plus the fact that for some strange reason holders of railroad securities never seem to think of urging their senators and representatives to do anything in their interest.

However, the most important Washington picture for manufacturers and business men generally to watch has been transferred from Capitol Hill, by the adjournment of Congress, to a good many states and congressional districts scattered about the country.

The effort of the Administration to "purge" the Democratic Party of non-New Deal senators, especially those who opposed the President on the Supreme Court enlargement, is the most important phase of this. But the private "purge" list of John L. Lewis, of CIO, must also be taken into consideration.

Lewis will never forgive the rebuff he suffered in the closing days of the House, when he got nothing but harsh words when he attempted to force through the amendments to the Walsh-Healey Bill, which would have blacklisted manufacturers cited by the Labor Relations Board without their having a chance to take their cases to court.

His grievance lies particularly against the membership of the House Rules Committee, and the one shining mark there is Representative E. E. Cox of Georgia. Cox rubbed salt in Lewis's wounds by making a public statement referring to Lewis and his "communist cohorts."

It so happens that the White House is also gunning for Mr. Cox, and the decision will come on the same day in September that it hopes to "get" Senator Walter F. George. Lewis of course simply *must* demonstrate his power somehow. He has been kicked three times now, in places where it hurt a lot. First in Pennsylvania, where his old miners' vote was not enough to win. Second in Iowa, where his lieutenants were backing the New Deal candidate against Senator Gillette. And finally in the House Rules Committee.

AMERICANS TO STUDY BRITISH LABOR LAWS

With the President sending a delegation abroad this summer to study British labor laws and their applicability to our own problems, *Factory* readers will find it helpful to review two recent articles:

1. Labor Laws in Great Britain (March, 1937)

A study of the British Trade Disputes and Trade Unions Act of 1927

2. A Case in British Labor Relations (November, 1937)

Practical application of an idealistic labor philosophy in the plants of Imperial Chemical Industries Limited

Materials Handling

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Elwell-Parker photograph

The Triple Threat

WHEN a plant manager starts out to cut costs, chances are 10 to 1 he will settle on at least one of three widely hailed potentials for important money savings —plant layout, motion economy, and the mechanical handling of materials.

And the plant manager who wants to do a really thorough job of cutting his operating costs will not fail to "look at all three."

Which, in point of fact, it is quite impossible not to do. For usually, in any given situation, the three trains of attack are so closely intermeshed that it is hard to tell where one leaves off and another begins.

Start with plant layout, for instance. How quickly and how deeply you get involved with mechanical handling and motion economy! Or begin a program of work simplification and see how far you can go before you bump into plant layout or materials handling—or both.

All this must be true because effective manufacture, whatever the product, demands minimum movement of men and materials. And one cannot have minimum movement of men and materials without the best possible arrangement of production machinery and equipment—*and* without the conservation of wage earner time and effort through effective use of mechanical handling equipment.

The foregoing statements are purposefully matter-of-fact. But the job of reducing plant costs is not. In fact, it is one task that is never ended. No one has ever done so good a job of plant layout that someone else couldn't come along tomorrow and make at least some minor improvement in it. And up to last night, anyway, the process chart enthusiasts were still using quotes when they spoke or wrote of the "one best way."

New methods and new equipment have much to do with making this triple attack on plant costs a continuing one. These are not days when complacent plant managers may lay out their factories "for keeps." These are not days when the modern plant looks like something out of the pages of the scientific journals for 1880. These are fast-moving times when nothing is sure but change. In such times the smart manager is he who lays out his plant as utterly flexible as he can make it, and shifts it constantly to meet the conditions of the moment.

Entire Operation Involved

For any but the simplest type of manufacture, this job of plant layout, with its sure-as-shooting excursions into the adjoining fields of work simplification and materials handling, should not be tackled without recognizing that the entire plant operation is involved. An examination of the whole production procedure must be made. Basic principles must be determined and applied. A tremendous amount of detail must be painstakingly followed through.

Indeed, before the particular job in hand is finished, a thorough analysis of machine replacement may easily become necessary. Or a revision of wage payment methods may have been called for. Or a complete recasting of the supervisory organization and their duties.

These are but a few of the bypaths down whose twisting lengths the venturesome plant manager may have to

Vacuum lifters specially designed to handle sheets of glass, team with 5-ton crane (Whiting) to confound the manly art of tugging and hauling

edge his way when once he takes on this perpetual job. But, in spite of these intricacies and many others, there have been cases without number where new layouts have paid for themselves in short order and gone on in the long haul to add to net profits.

The best of them emphasize the inherent relationship of mechanical handling and motion economy to plant layout, and prove the futility of trying to apply any one of the three without also applying the other two.

Of course, it is this chance of adding to profits that injects the *real* zest into this whole business of cutting plant operation costs. And it is industry's sudden realization of this inherent relationship that has lifted the handling of materials out of its early status as a series of totally unrelated moves to its present standing as a major consideration in the planning that inevitably accompanies any successful manufacturing venture.

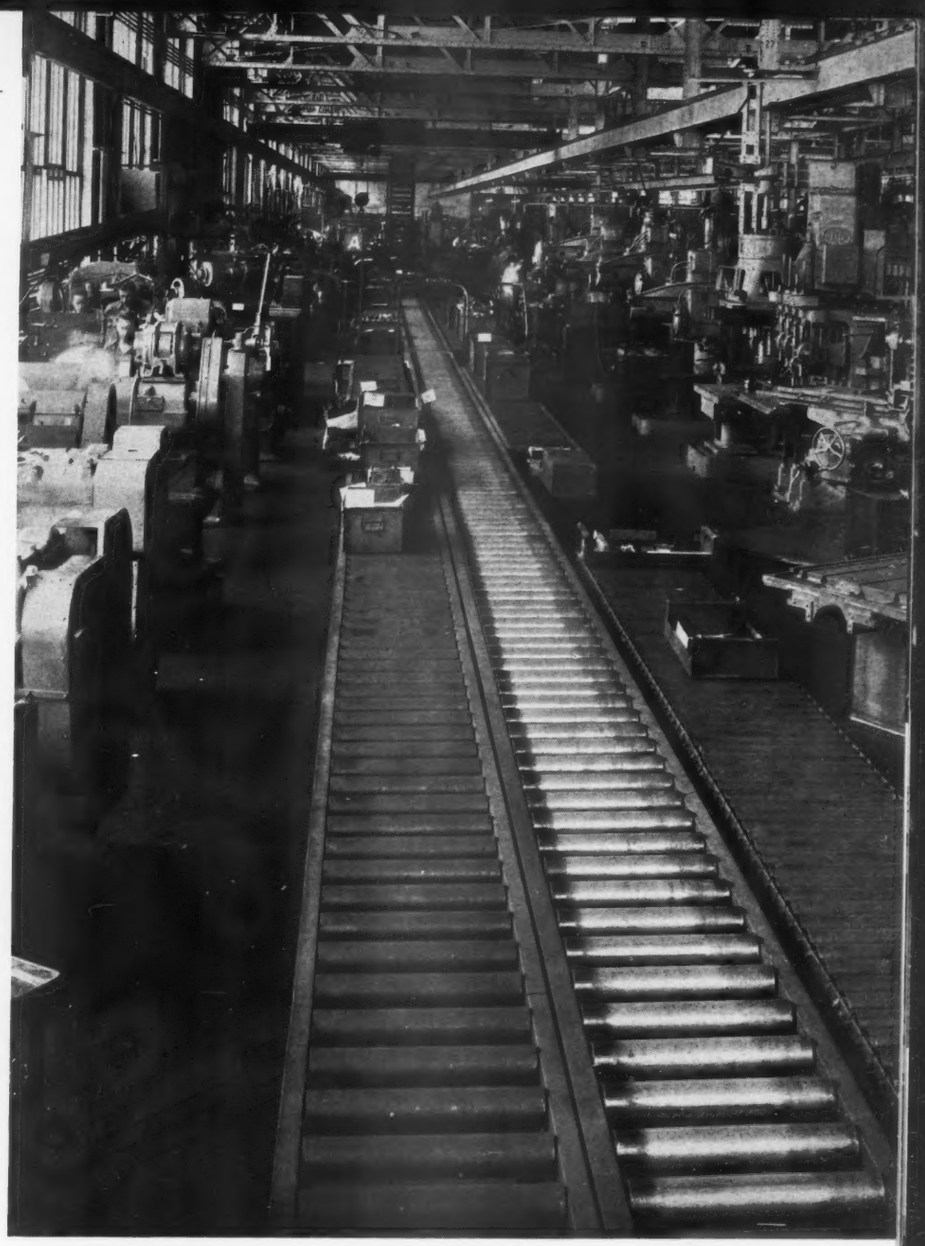
Mistakes in Geography

Time was—and it wasn't so long ago—when handling equipment was chiefly used as a means of overcoming mistakes in plant geography, when it was just a way of moving materials from here to there. There was even a day when, in some plants, mechanical handling was one of the chief ends of management. It was handling for handling's sake. Great "systems" blossomed forth, on which materials were truly taken for a ride —"systems" at which sundry big shots could point the gesticulating finger of pride.

But today handling is in the picture from the beginning, whether it's new plants that are being built, or old plants that are getting a good going over, or just regular plants that have to be shifted here and there to meet changing conditions.

Think of the haphazard layout methods of the past that more often than not resulted in another new building to add confusion to an already overgrown plant, and contrast the ease and effectiveness with which Plymouth engineers take up the shocks to which even minor model changes may subject the delicately attuned manufacturing structure. We think of Plymouth mainly because the interested reader can turn in a jiffy to another part of this issue and see just what goes on there.

Briefly, they have what they call the "big board." And on it they show the more than a million square feet of manufacturing space included in the huge Detroit plant. When layout changes are made, they are recorded on the board in permanent form—permanent, that is, until it's time to change again.



Close coordination of plant layout, materials handling, and work simplification. Conveyors (Logan) see to it that machines don't loaf on the job, insure steady flow of materials. Center line is main line, with live rolls. Tote boxes are transferred for machine operations to idler rolls

Beauty of the board is that it gives the whole picture. Not just the department that has to be changed, but that department and all the other departments in the plant. And of course that department in exact relation to all the other departments.

A dozen men who have a direct stake in the proposed changes can stand in front of the board and argue them out to their hearts' content. They can discuss what ought to be done and how best to do it. The board is laid out to scale, by the way, so it's never necessary to hold everything while someone runs out into the shop and puts a tape on some machine or piece of equipment.

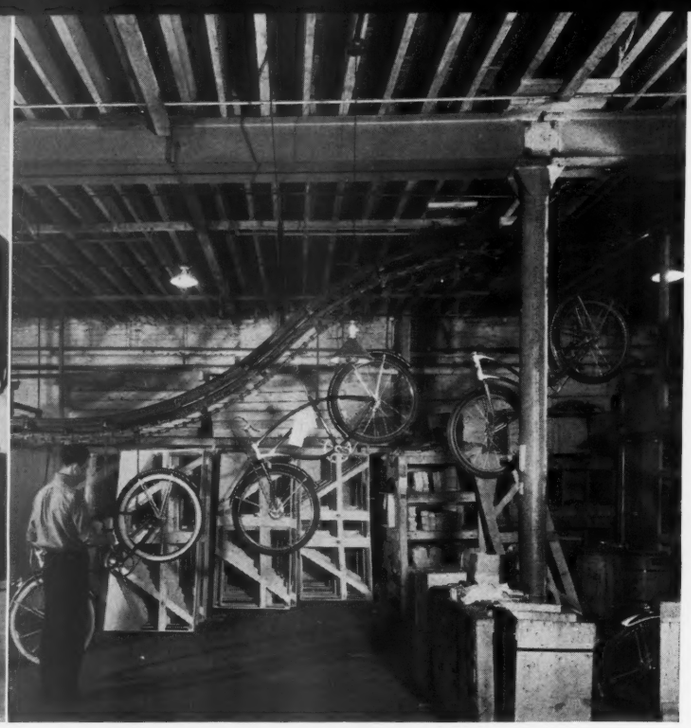
Handling? It's there, too. Naturally the mobile types of equipment—floor trucks and lift trucks and tractors—don't have to show. But conveyor lines are there in black and white, for all to see.

Floor conveyors are black. Roller conveyors have a cream band. And overhead chain conveyors are shown in all their maze of ascending and descending sections, dipping here to the floor for convenience in loading or unloading, running up there to avoid an aisleway.

Wire strands, carried on fishhooks that can be easily pushed into the board, leave none of the overhead transportation system to the imagination. Could anyone make a mistake with the whole show thus spread out on the wall before his very eyes?

However, you are pretty sick and

Special attachments like the barrel pick-up on this 2-ton high-platform truck (Yale & Towne) bear witness to industry's recognition of the close tie-up between the economy of time and motion and materials handling



Overhead chain conveyor (Link-Belt) is readily adapted to needs and vagaries of modern plant layout, dips here on its way from final assembly for convenient unloading in shipping room of Chicago bicycle manufacturer

tired of having the automobile people thrown up to you as shining exponents of industrial management as it ought to be practised.

So let's take Westinghouse. But you object. Another big concern. Yes, but this is the story of how the big concern, confronted with the need for more space for one of its newer products, set up a small, self-contained plant inside its sprawling East Pittsburgh works.

Details are told in last month's *Factory*. All we want to do here is point out what an important part the handling of materials played in the original planning. The entire operation, indeed, is built around the handling job. Here we have practically perfect coordination of such widely differing types of handling equipment as floor trucks, roller and belt and slat conveyors, tractors and trailers, elevators, cranes, and hoists.

Here, if you please, is the true handling *system*, without the quotes around that much overworked word. Here again we find layout, work simplification, and materials handling all wrapped up in the one package.

Make It Tomorrow

Here, also, is utter flexibility of layout, hence of handling methods. Decide on a change today. Make it tomorrow. In full production the day after. Here is provision for easy, gradual expansion—something that is too often overlooked in the early planning.

Each of the typical handling installations on the succeeding pages has made money for some one concern, can make money for many another with a similar job on its hands. Treatment is photographic. Pictures tell the story quicker, often more completely. Classification of photographs is along natural flow lines

We might cite the case of the concern that wrapped its new and ultra-modern building around its handling. Then there is the instrument manufacturer who knew it took too long to get out orders, who therefore set out to revamp his handling, and wound up not only with one of the last words in handling systems, but also with a brand-new layout. And to show that this sort of thing is no respecter of industries, there is the company that makes what it seems to us they call foundation garments. It started off on the motion economy tangent, soon found it owned a new layout, not to speak of better and more economical handling methods.

We could even cite a certain outfit that right now is planning a new press shop and is making all its tentative layouts in isometric projection, the idea being that in this way it is easier to visualize the various departments in a multi-story building and see them in correct relationship, one to another. It is thus possible to locate conveyor lines and truck routes with an eye to the complete show.

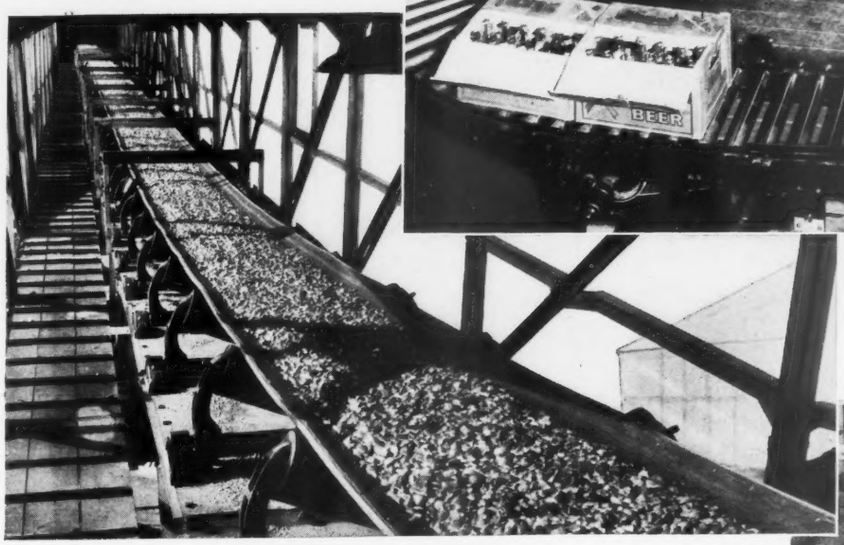
Will Gain Yardage

This is one method of avoiding the mistakes in plant geography that are so hard to correct later on. Another is through the use of three-dimensional models, which are finding increasing favor. They have no equals when it comes to selling the Works Manager, the Manufacturing Committee, or the Board of Directors. And selling the new layout or the new handling system to the powers that be may be your biggest job.

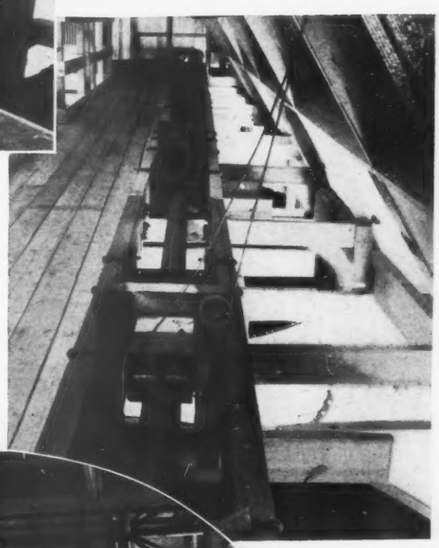
That is no part of this story, however. Here we have tried only to indicate industry's realization of the inherent relationship of three cost-cutting methods commonly employed today—and to suggest the possible uses to which they may be put. In plant layout, motion economy, and mechanical handling, industry has the nearest thing to a triple threat that can be found off the gridiron—a threat that can be counted on any time, any place, to gain much yardage in the big game of reducing operation costs. It's a game that plants in the manufacturing industries can play with profit at any time. The rules are simple, the gate receipts amazing.

Into the Plant

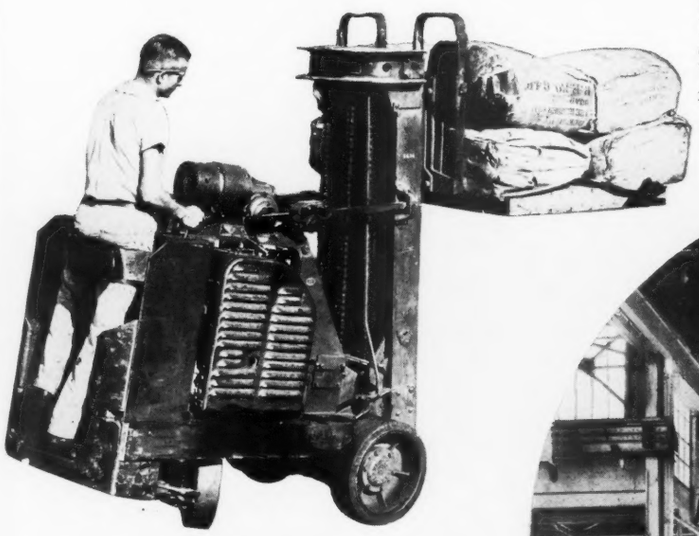
Empty bottles, unloaded simultaneously from four trucks, ride into a St. Paul brewery on (Standard) continuous-belt live roller and gravity conveyors



Main conveyor (Stephens-Adamson) in Baltimore concrete batching plant elevates sand, gravel, stone to bins over automatic batch weighers



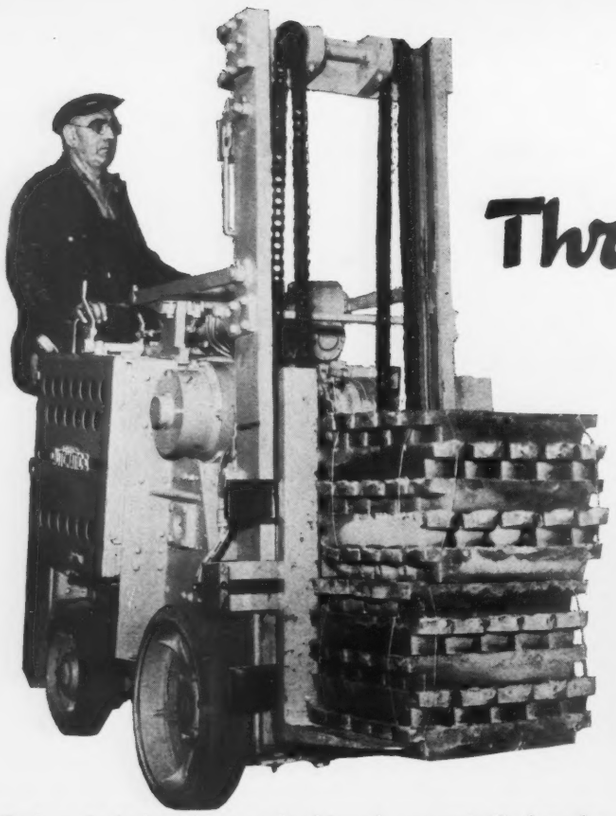
Glauber salt is lifted 60 ft. via (Johns) conveyor belt, dumped into one of eight bins. Weighted rollers force belt open



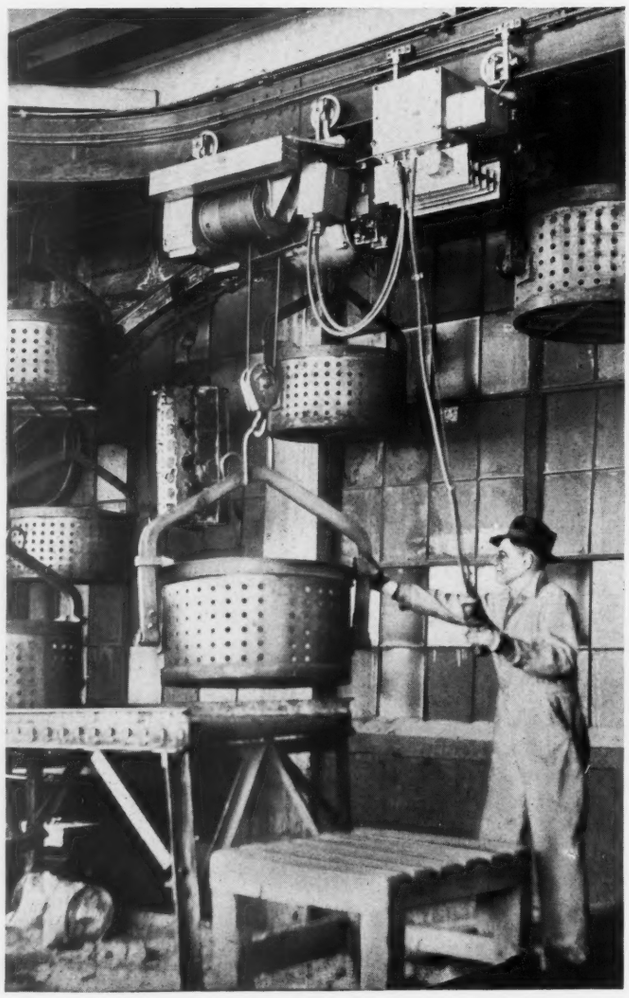
Crude rubber in bales is tiered on pallets, moved to production lines by (Elwell-Parker) fork truck

Man in crane (Harnischfeger) with grab specially designed to handle bundles of steel sheets, helps man in car unload, makes short work of a one-time back-breaking job

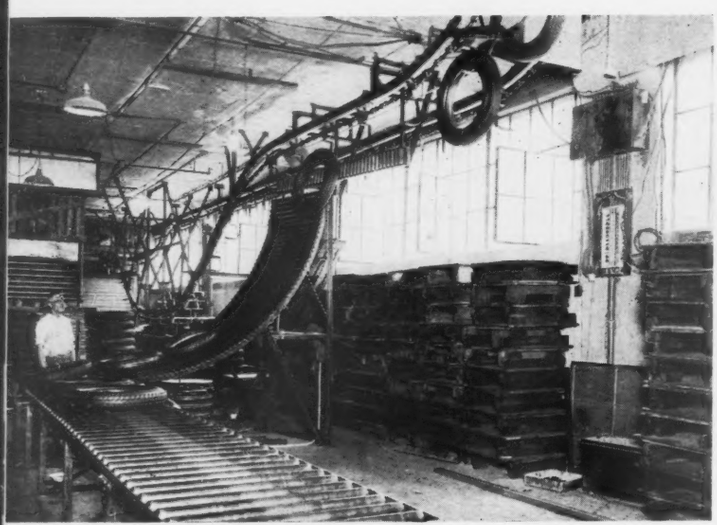
Through the Plant



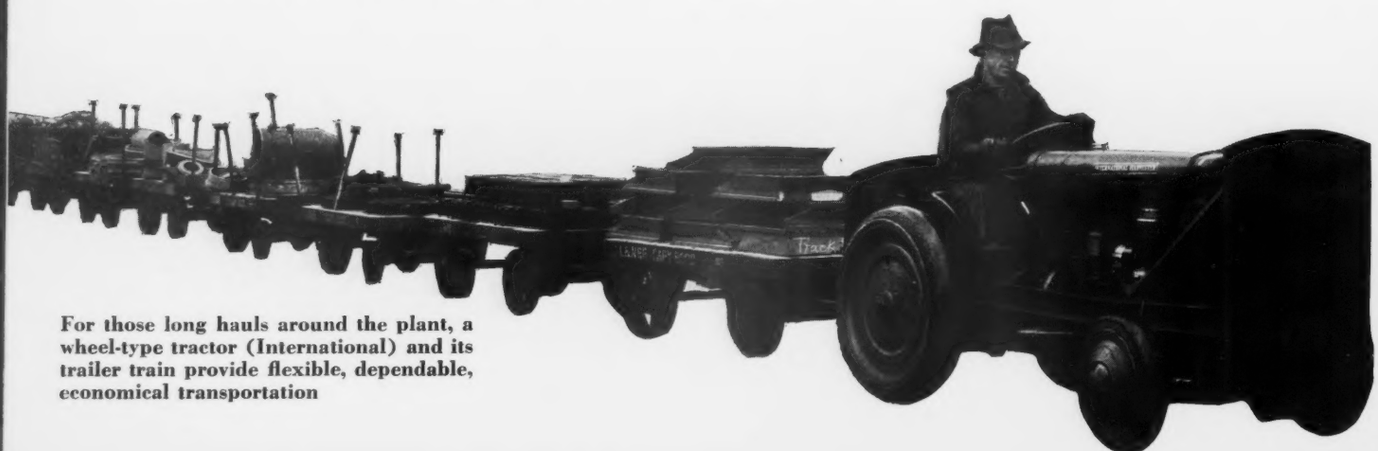
Packaged pig lead is not only shipped economically but also unloaded quickly by fork truck (Automatic) and transported to processing operations. This load weighs 2 tons



Dipping buckets are carried to a roller conveyor in automobile plant on monorail (American) via floor-operated electric hoist. Buckets are then pushed into position to engage with hooks on chain-driven trolley system



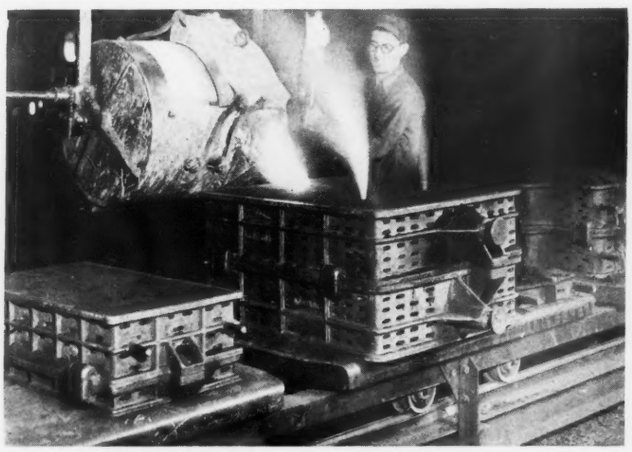
Chain-type trolley and live roller conveyors (Mathews) handle automobile tires to a T in this rubber plant. Note how tires are persuaded to leave their hooks on the chain and shoot the chute to the belt-driven rollers down below



For those long hauls around the plant, a wheel-type tractor (International) and its trailer train provide flexible, dependable, economical transportation

Three-ton electric crane (Conco) works over the pouring floor, provides speedy and safe handling of cores to and from the baking ovens in a Rockford, Ill., foundry

Steel is moved from storage to planer in automatic parts plant by 3-ton telescopic tractor (Clark), which has wide carrying and tiering range

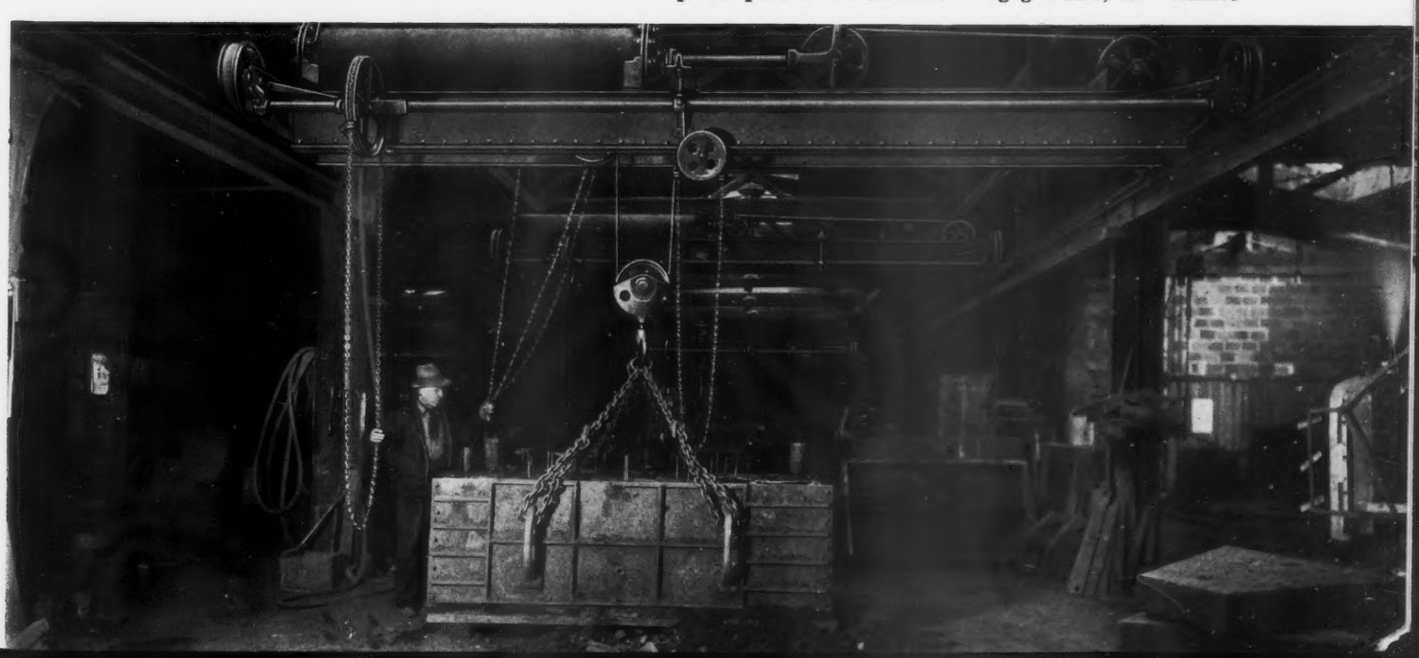


Pouring a heavy casing on the move saves time and effort, hence money, in this tractor manufacturer's plant. Molds ride a (Chain Belt) power conveyor

Flexibility in handling heavy jobs in a tool and die shop is provided by two 15-ton cranes (Northern) servicing the main bay, and six 10-ton cranes that work the side bays

Cores fresh from the oven are transferred at this critical junction point from an overhead conveyor line (Mechanical Handling Systems) to a gravity roller section

Depreciated at rate of 5 per cent per annum, these cranes and hoists (Curtis) were charged off the books five years ago, are still delivering the goods in a plant that makes special production machines—big grinders, for instance

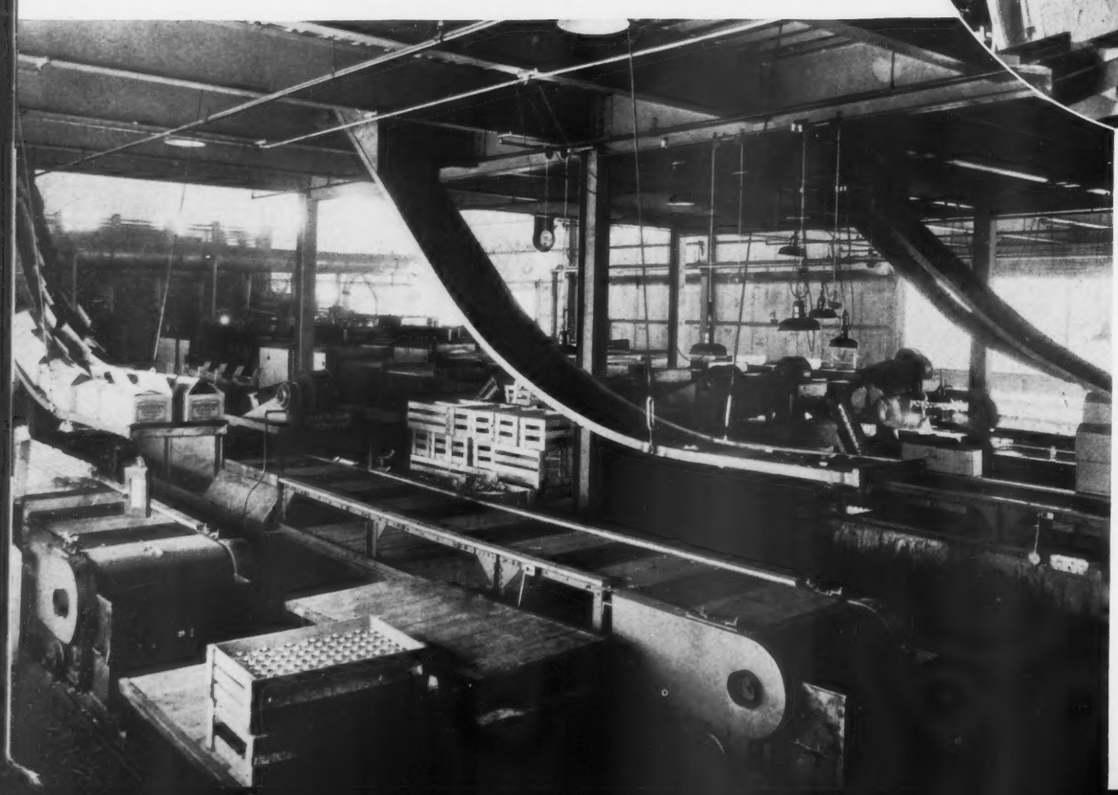


Overhead conveyor (Link-Belt) in large hosiery mill carries boxes containing filled orders from order-filling department down to order packers on the first floor

Elevating truck (Baker-Raulang) is the mainstay of the handling system in this plant. Here a 3-ton power truck handles skid boxes of small motor parts

Down the Lines

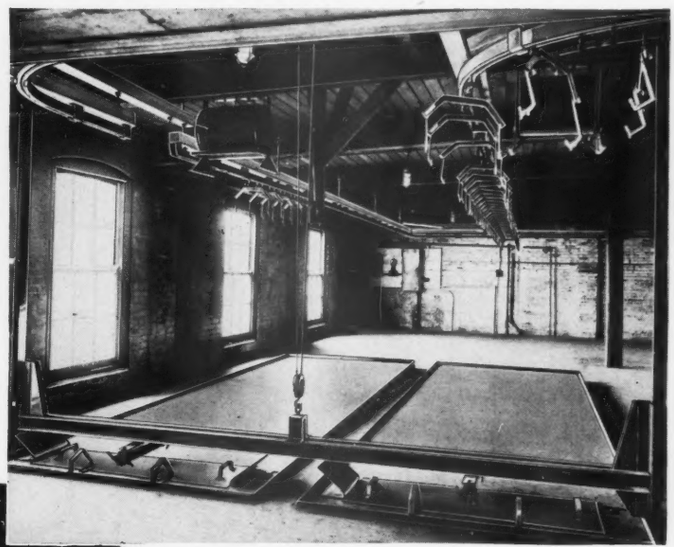
Where floor space is at a premium, the overhead trolley conveyor often gets first call. This overhead chain (Mathews) does the between-jobs handling in a cigarette factory



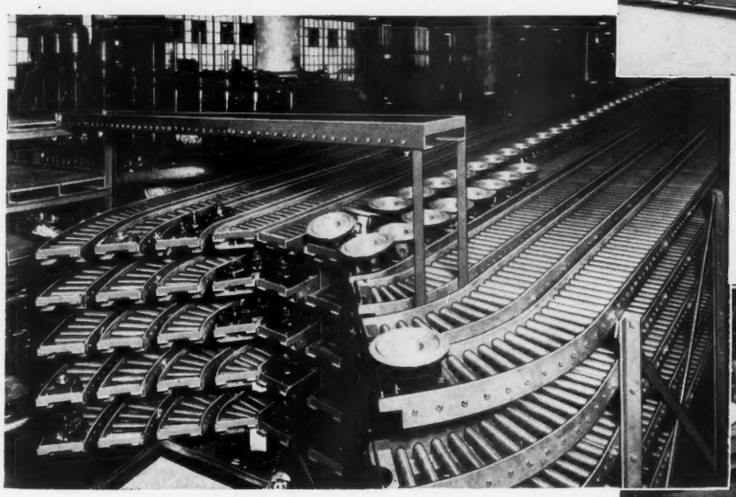
Electrically heated, variable-speed lehr conveyors (Stephens-Adamson) carry glassware through tempering ovens and then cool it for packing. Chutes bring empty cartons from floor above

Advantage of horizontal slat conveyor is that operators may ride with the job, as on this conveyor (Standard) used for refrigerator assembly in one of the larger electrical manufacturing plants

Stacker (Lewis-Shepard) makes itself useful in can plant where it moves stock from storage to presses, keeps it at the proper feeding level

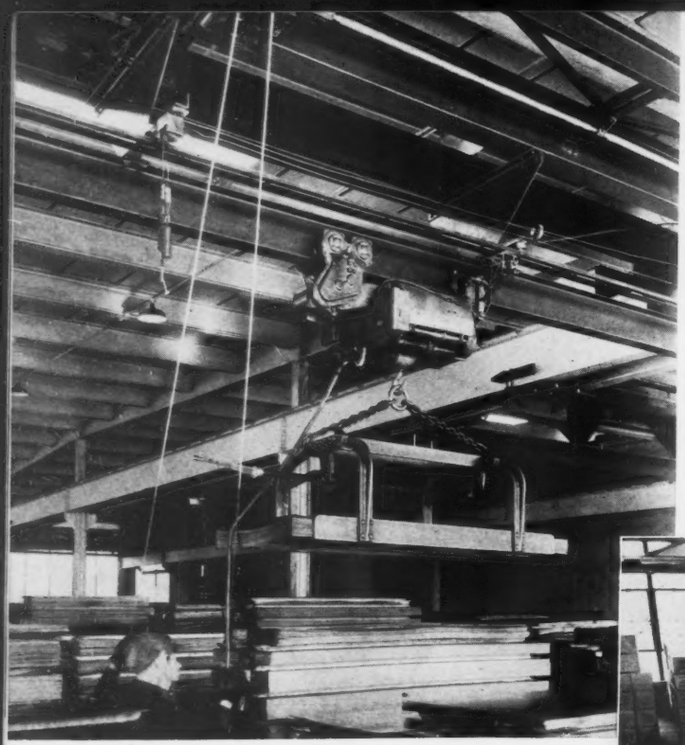


Overhead conveyor (Richards-Wilcox) handles bedsprings through dipping tanks and then on to adjacent drying area

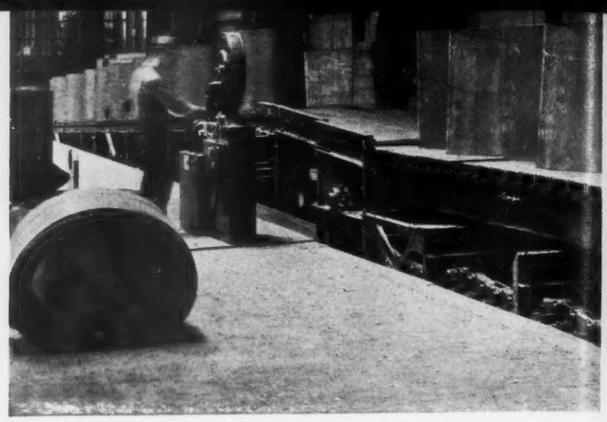


Electrical manufacturer uses gravity roller conveyor storage rack (Logan) to form an ever-ready "bank" for small motor parts

Radio sets travel from operation to operation on gravity roller conveyors (Olson) and are then delivered to inclined belt conveyors



Three-ton motor-driven hoist (American Engineering), mounted on traveling beam, performs nobly on heavy lifting jobs in storage areas



Pallet-type conveyor (Jeffrey) moves coils of steel to storage after inspection and weighing operations in a continuous strip mill

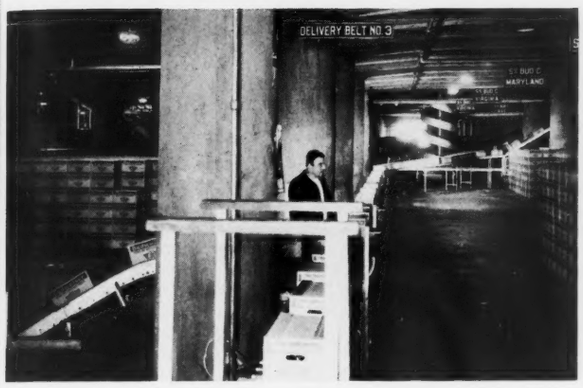
Paint manufacturer has handling system (Lamson) instead of the series of totally unrelated move jobs too often found even in the best of plants

To and From Storage

Tilting telescope fork truck (Mercury) makes light work of handling heavy pallet loads of refrigerator materials to storage

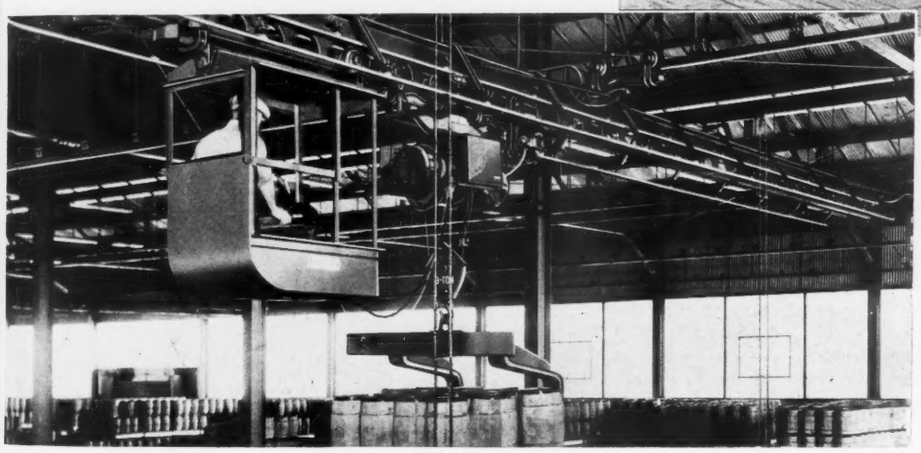
Concrete pipe is hauled from kiln to storage yard by this (Caterpillar) diesel tractor

In a modern continuous strip mill, heavy-duty ram tractor (Automatic) handles steel coils up to 16,000 lb. weight

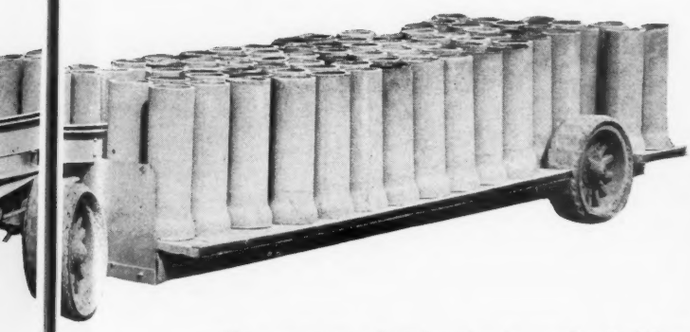


Live roller conveyor (Alvey-Ferguson) advances packaged beer to various storage stations in a big brewer's warehouse

High tiering with fork truck (Baker-Raulang) and pallets increases storage space. Here, barbed wire and kegs of nails are tiered to the roof

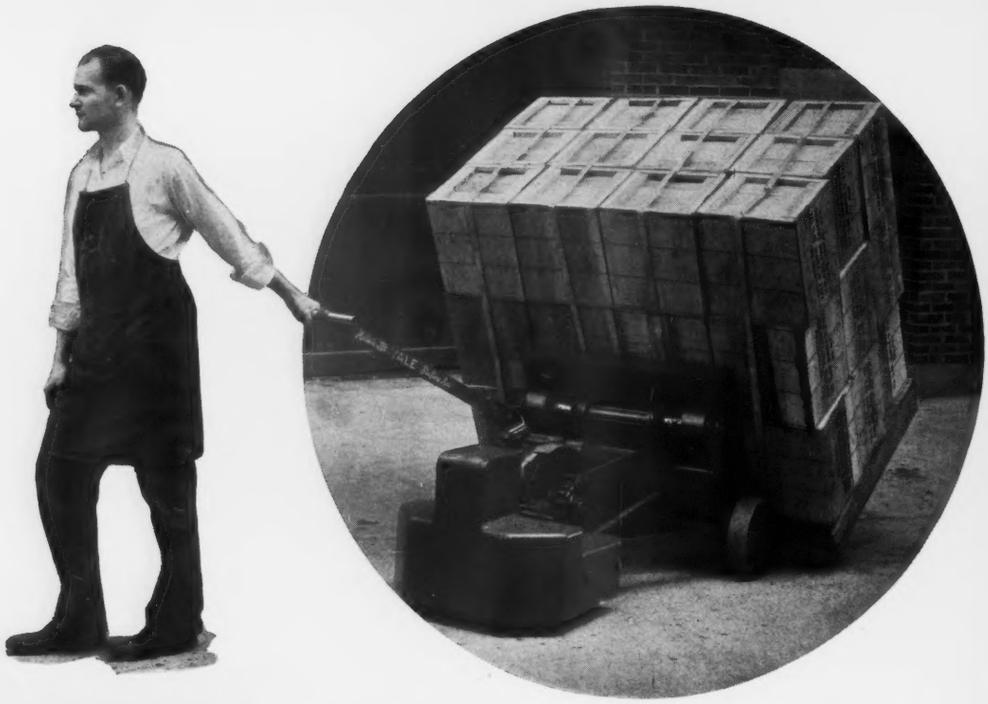


Cab-operated crane (Cleveland Tramrail) serves steel company's warehouse, picks up in each lift 32 kegs of nails, each keg weighing 100 lb., and piles them high



No respecter of industries is mechanical handling. High-lift truck (Towmotor) moves skid loads of folded packing boxes in lumber mill

Out the Door



Skid platforms and steel strapping make a package out of this heavy load of parts that is easily handled with a hand-lift (Yale) truck

Portable sections of roller conveyor (Lamson) save time and effort in loading cartons of paint into freight cars

Skidding a 30-ton kiln becomes something more nearly like child's play when this 1½-ton hoist (Coffing) gets down to business

Gas-powered truck (Clark), 2-ton capacity, moves reclaimed rubber from mills or warehouse to cars on company siding

Pallet loads of cartoned cosmetics are handled from warehouse via high-lift tilting fork truck (Mercury) and placed where they can slide through the wall to waiting trucks or cars

Low Inventories, Because—

No wrong guesses are made; time element is removed. Here's a plan for controlling material costs that works like a charm in a 200-man plant making 1,500-odd items in a highly competitive industry

W. C. ZINCK
Industrial Engineer
North & Judd Manufacturing Co., Inc., New Britain, Conn.

OUTLINED HERE is a plan for the control of materials which has shown decided improvements in a branch factory* with 200 employees, operating in a highly competitive industry.

The organization of the plant under the former management was poor—in all fairness. Materials were not purchased economically, expensive substitutions were common. Production control did not stem from customers' orders but from the ideas of the assembly foreman. Cost control was absent, although a late-comer to the organization had succeeded in having work done on order numbers, an accomplishment that eliminated much spade work in establishing the production controls to be described. All in all, the plant was ripe for a thorough reorganization.

Monthly Budget

General management operates the branch plant through a monthly budget based on expected orders. Allotments are given for raw materials, factory labor, supplies, and general expense. The original percentages for each allowance were established from the results of the first full year of operation. Current figures are adjusted to accumulating operating experience and to trends in material and labor costs.

Factory management is effected by a staff of eight. The works manager supervises the factory as a whole, acts also as purchasing agent and cost accountant. The superintendent supervises the factory operations and the production group, consisting of stock clerk, production clerk, and production record clerk. The cost clerk estimates costs of new work, sets piecework rates by time study, and with the payroll clerk prepares the labor costs reports. The stenographer-clerk handles all correspondence and keeps the purchasing records as well.

Paperwork and controls thus had to require a minimum of clerical work and be unusually effective if eight people were to control 200 employees making 1,500 articles, from two classes of raw materials, supplied to customers in three or more different finishes.

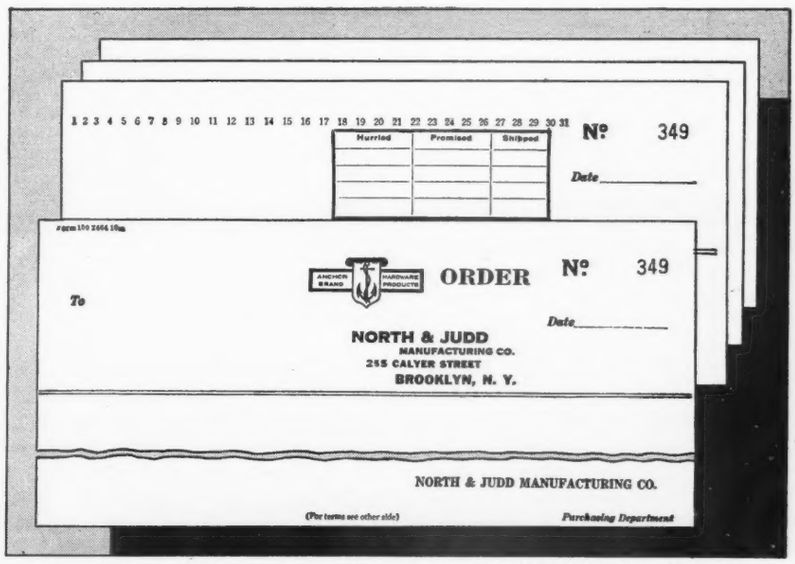


Figure 1. Materials and supplies are purchased through formal orders based on requisitions from the factory

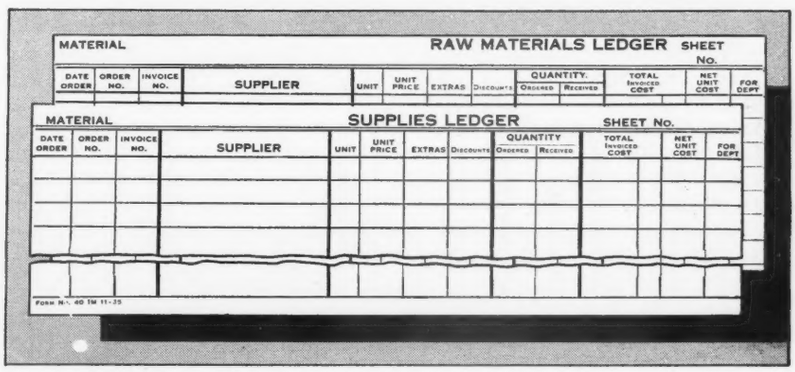
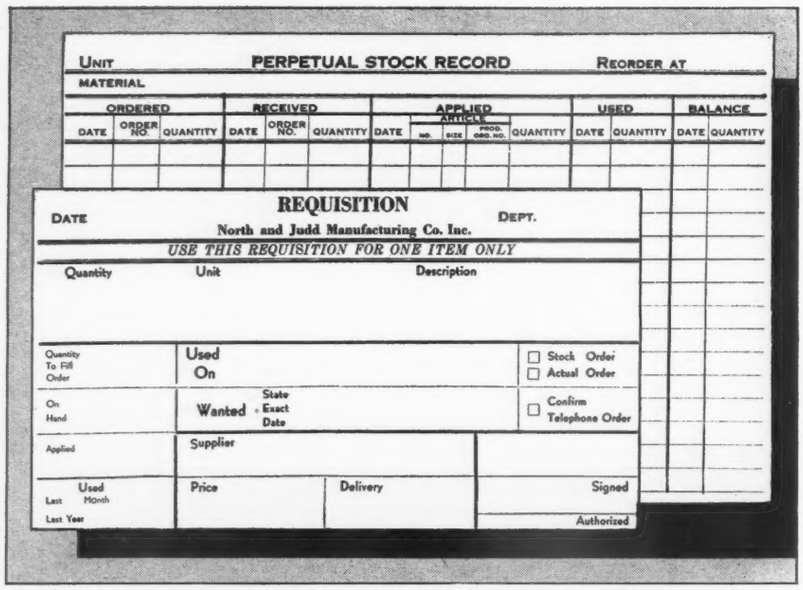


Figure 2. Basic records of raw materials and supplies are accumulated on these ledger cards

Manufacturing costs are controlled in three major groups—materials, production, and labor. Material checking starts with issuance of a requisition and finishes with quarterly comparisons of costs. Production control begins with customers' orders, includes promise dates for shipments, and ends with shipping receipt sent to invoice department. Labor cost control endeavors to get maximum productive labor with minimum non-productive labor.

Non-productive labor is checked also for its own effectiveness as a

* Since *Factory* asked Mr. Zinck to write this article and its two companion pieces, operations have been moved from this branch establishment to the main plant. This change does not, of course, detract in any way from the value of the controls that the author describes.—Ed.



Figures 3 and 4. Requisitions for steel, brass, wire, and other major raw materials go to the works manager together with the perpetual stock record of each item. He decides how much to order

producer of service. This applies especially to toolroom expense. Quantity and quality are watched. Factory loss, or "slippage," cannot be concealed. Its routine control is fair, open, and close. Each foreman knows there is a strict accounting of the total work on every order—a knowledge that has a salutary effect.

Control of Materials

Requisitions from the factory are required for all materials and supplies. All requisitions are authorized by the works manager.

Materials and supplies are purchased through formal purchase orders (Figure 1), which are typed in quadruplicate from the requisitions. The original copy goes to the suppliers, the duplicate is used as a follow-up, the triplicate is the receiving clerk's copy, the fourth is the office copy.

Basic records for raw materials and supplies are accumulated on ledger cards, one set headed "Raw Materials Ledger," the other "Supplies Ledger." The cards (Figure 2) are similar except for the headings. Each raw material and major supply item has a separate card, while specific groups of operating supplies—for example, "Millwright Supplies" or "Janitor's Supplies"—have a general card.

Commitments for materials and supplies are posted to the ledger cards from office copies of purchase orders.

Two receiving books are used for recording the goods received—one the "Monday, Wednesday, and Friday" book, the other the "Tuesday, Thursday, and Saturday" book. This allows one receiving book to be sent to the office and kept there for a day to be posted when convenient. Each item as received is checked against the receiving room copy of the purchase order for it; if as ordered, the order number, quantity accepted, article, and name of supplier are posted.

The receiving book is posted to the ledger cards, each entry being identified by the order number. The entries are quantity received and date of receipt, both noted in pencil.

Incoming invoices are passed through the ledger cards, by checking unit price, extra discounts, and quantity invoiced, and by recording invoice number and total invoice cost. If quantity billed corresponds to quantity received, the quantity received is posted in ink.

Any difference between invoice and entry on ledger card is taken up with the works manager. The date the merchandise was received is posted to invoice from ledger card. The invoices are approved by the general manager, and then mailed to the home office for payment. A forwarding sheet is made of invoices sent, giving the date, number, suppliers, and total amount. This record has proved a valuable check against lost invoices by fixing responsibility for slow handling.

Control of material costs is obtained from individual ledger cards; from daily, weekly, and monthly totals of each class of commitments; and from quarterly totals for each group of raw materials. The ledger card of each item shows in chronological order dates, suppliers, quantities, and prices of various lots bought. A careful study of each card will therefore indicate possibilities of getting lower prices through better discounts by ordering larger quantities if the consumption is at all heavy on contracted goods, and by "shopping around" on non-contracted goods. These cumulative data on each item are invaluable in placing purchase orders economically.

Control of commitments is obtained by comparing totals for each class of commitment, raw materials, supplies, general expense, with respective budget allotments. Thus the works manager can see the trends of the purchases and take the necessary executive action the comparisons indicate.

He checks carefully to see if any excesses of commitments over budget allowances can be justified, and equally as carefully to see that low commitments will not be detrimental in the near or distant future to the operation of the plant. And he keeps in mind that each month's expense influences future budget allotments, and that he is judged not upon whether what was spent was low or high, but whether what was spent gave quality merchandise and good service to customers at an acceptable profit to the company. A budget is a means to an end—profit—not an end in itself.

Commitments and invoices are compared because total commitments and total bills must be reconciled in order to control effectively by watching commitments. Keeping commitments and bills in satisfactory relationship will require enough attention of the works manager to assure that clerical work is correct, that everything is purchased with a formal purchase order, and that values of overshipments are posted to commitments.

Valuable Guide Posts

Quarterly totals of individual items of each major class of expense are posted to control sheets, provide valuable guide posts to reduce expenditures. Totals such as "total cold-rolled steel purchased" must check with sales of articles using steel, and the same for brass and wire.

Cost of plating materials must agree with pounds plated, enamels with gross sprayed, and so forth. Maintenance supplies, operating sup-

(*Continued on page 128*)

Organized to Prevent Breakdowns

It's less costly to prevent trouble than to patch things up afterward. You can't do it without proper personnel and a clear picture of the true function of maintenance

B. L. BAILIE
Plant Engineer
Hiram Walker & Sons, Inc.
Peoria, Ill.

MANY plant executives and owners who have grown up with their business and have seen it expand and grow into a huge organization, still remember the days when the engineer watched the steam, handled the firing, found time to repair a belt, and do a little oiling. If a new piece of machinery were purchased, one of the old hands, with a couple of yard men, set it up.

Those were the days when the plant whistle blew at 6 a.m. and again at 6 in the evening, and every person worked a full day on Saturday. If any serious interruption occurred, orders were delayed for a day or so, but it made little difference.

There is little need to stress the point that conditions are vastly different today. The old engineer and his force of one or two handymen have grown into a large department distinguished by its own name and composed of men skilled in many different trades or crafts.

Obviously the maintenance department must be properly organized to serve its plant and trained to keep the production equipment in efficient operating condition. To do this effectively, requires that certain conditions be met and that many details be watched. For example, the men must have more than a general knowledge of the loss that is suffered annually by industrial plants as a result of erosion, corrosion, poor lubrication, and "cheap" buying. There must be the proper kinds and amounts of repair parts on hand, and proper tools to handle replacements and perform all work in the shortest possible time.

Trained Men Needed

Primary requirement for any maintenance organization is manpower. There must be enough mechanics, trained men—men who have the ability to handle their respective jobs. New men must be stimulated to acquire whatever knowledge is needed of the particular requirements of the job assigned to them. Our foremen have been schooled to understand that no company can maintain a high standard of pay and receive in exchange poor workmanship. They realize that this department's chief function is to serve, because costly breakdowns can be eliminated only by constant supervision.

We proceed on the theory that protective maintenance is the best and safest insurance we can buy. That calls for thorough and frequent inspection of all equipment. To this end, men are assigned to different buildings and are held responsible for the performance of certain equipment. They are trained, often by the experience of unusual failures, to be on the alert for trouble. In this way depreciation of equipment is reduced to a minimum.

Our men realize that the maintenance department has the big responsibility of making it possible for others to maintain production. Its purpose is to anticipate and prevent interruptions to operation. We have trained our men to realize that any profit a plant makes, comes as the result of manufacturing efficiency. It is important that equal efficiency be shown in all operations performed by the maintenance division, or these profits are going to be reduced.

It may be argued that this department may be regarded merely as a necessary adjunct to make general repairs, but the fact is that with the proper personnel the maintenance department will not only keep a plant operating smoothly, but will also bring about improvements of various kinds which will also pay dividends.

Will Pay Dividends

Maintenance presents a problem of careful planning, which is complicated by the fact that emergency jobs will arise. Therefore, it is essential that the department be organized so as to be in position to cope with any unexpected item of work, small or large, with the least possible loss of time or interruption of regular routine.

Our Peoria plant comprises the world's largest distillery. In it there is more than 500,000 sq.ft. of floor area, exclusive of ten warehouses, occupied by the equipment used by this

Interesting features on the operating floor of the still tower are the controlling instrument panel and the large amount of piping

type of manufacturing establishment.

Power for this equipment is furnished by 906 motors, ranging from 250- to fractional-horsepower rating. Some of the other equipment and the operations involved are:

Controlled Cooking

Grain is stored in the Mill Building where it is ground in three-high roller mills, of which there are twelve. It and the meal are handled by a pneumatic conveyor. There are eight 300-bu. steam pressure cookers, the cooking process being under automatic control. Mash pumps force the cooked material through coolers to one of 24, 107,337.5-gal. fermenters.

In the Still Building there are four 25,000-gal. continuous stills, one 15,000-gal. charge still, one 8,690-gal. re-run still, two 5,000-gal. gin stills, and one water still of 1,250-gal. per hr. capacity. The Rectifying Building contains two 500-gal. cordial stills, a rectifying column, and one 1,000-gal. per hr. water still.

Twelve 28,408-gal. and six 6,831-gal. storage tanks requiring batteries of valves and numerous pumps for the handling of the fresh whiskey spirits are located in the High Wines Building. In addition, four 28,708-gal. purifying tanks are located in the basement of this building.

Industrial alcohol is brought over to one of three weighing tanks of 14,220-gal. capacity. From these it is pumped to any one of nine 26,440-gal. storage tanks.

The Cistern Building houses twelve 13,642-gal. and six 6,831-gal. tanks, while the Bottling Building has a tank capacity of approximately 222,000 gallons.

There are ten bottling lines, each 65 ft. long, five assembly lines 35 ft. in length, and 8,000 ft. of gravity and power belt conveyors for carrying filled and empty cases.

In the Cereal Products Building, which handles the spent grain from the stills, approximately 900 tons of grain is dried per week, requiring six 8 ft. 6 in. x 28-ft. driers and twelve centrifuges. The liquid is evaporated by two sets of triple evaporators and a finishing pan, producing between 175,000 and 200,000 gal. of syrup per week.

Cooling All Grains

Incidental to this equipment is a grain cooling system which handles and cools all grain for shipping, pumps, tanks, screens, hammer mills, and so on.

The power house is in charge of the power engineer. His organization operates two bent-tube-type boilers rated at 150,000 lb. of steam per hour. In actual operation, however, each boiler is capable of generating 195,000 lb. of steam per hour. This equipment is fired with pulverized fuel, requiring the usual coal mills, scales, and other accessories. Electrical energy is produced by two extraction-type turbines, each of 1,500 kw. rated capacity. Water softeners with a capacity of 150,000 lb. per hour are also located in a portion of this unit, since all items of power and steam are under the supervision of the power engineer.

All repairs and changes in this department are handled by the maintenance department at the power engineer's direction, because he is entirely responsible for his equipment and his department.

To Avoid Lost Time

In the maintenance department there are well over 100 men, as will be seen from the organization chart (Figure 1). The maintenance supervisor is responsible for all plant maintenance. Second in charge is the shop foreman who is in control of all work in the machine shop and is responsible for parts inventories, tools, and repair stock. Next in charge is the electrical supervisor, and then come the various craft foremen. Boilermaker, coppersmith, electrician, ironworker, and so on, each has his own men to handle the work of their trades. Lines of authority are clearly defined and responsibility is definitely understood.

The control office plans all routine work and establishes the procedure for new work. It assigns the proper work to each trade and correlates the activities of all trades with each other in order to avoid lost time and motion and, in addition, handles all records of the department.

The maintenance department is housed in in its own building, known as the Service Building. The first floor is divided into departments, each group having its own equipment, benches, and other facilities. For example, the metal-working equipment includes one 24-in. and one 16-in. lathe, a milling machine, 32-in. shaper, hacksaw, bandsaw, benchsaw, grinder, 24-in. drillpress, small drillpress, roll groover, roll grinder, two pipe threaders, four electric welders, a 30-in. metallizing lathe, two metallizing guns, steel bending brake, and one 5-ton, 30-ft. overhead crane.

The toolroom located on the first floor is fully equipped with all needed tools and repair parts. All large and heavy parts are located on the second floor balcony and are in charge of the toolroom attendant. The paint shop is also located on this floor, along with the electric and the carpenter shops. The other end of the building is given

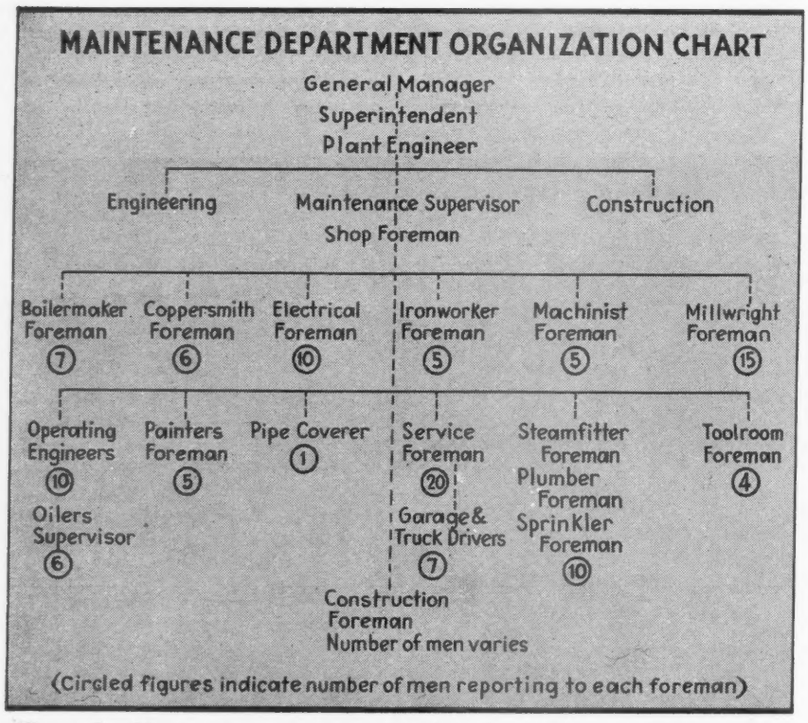
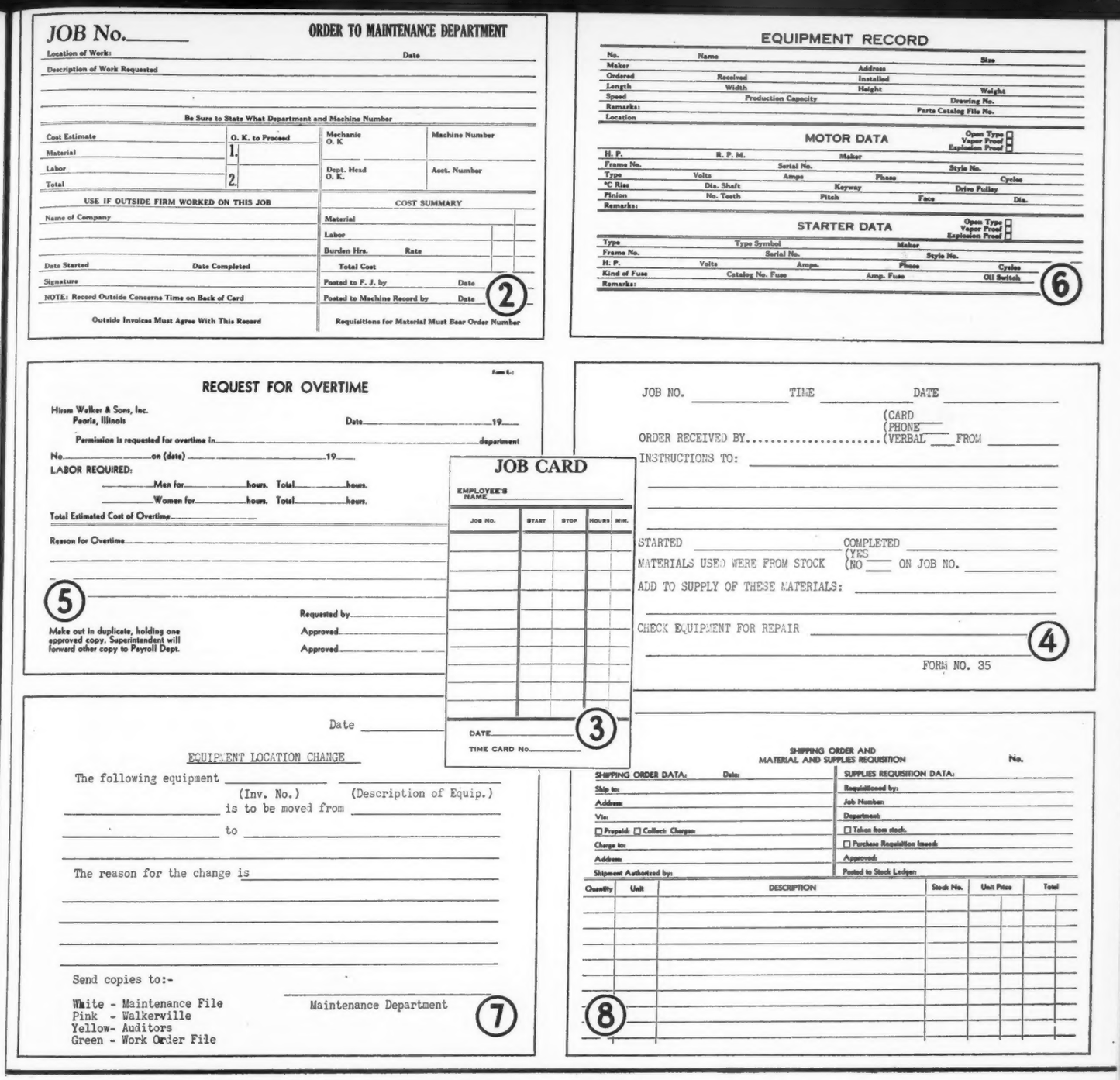


Figure 1. Manpower, properly organized, is the real key to effective maintenance; more than 100 trained men report to this maintenance supervisor



Figures 2 to 8. Well-planned paperwork is necessary for effective control of maintenance expense

over to the engineering department which is under the supervision of a highly trained and experienced mechanical engineer. The personnel of this department is made up of men experienced in architectural and structural work, as well as mechanical engineers.

The engineering department cooperates in the matter of standardization of equipment. In all large plants interchangeable parts, similar drives, motors, valves, and other equipment are essential for efficiency.

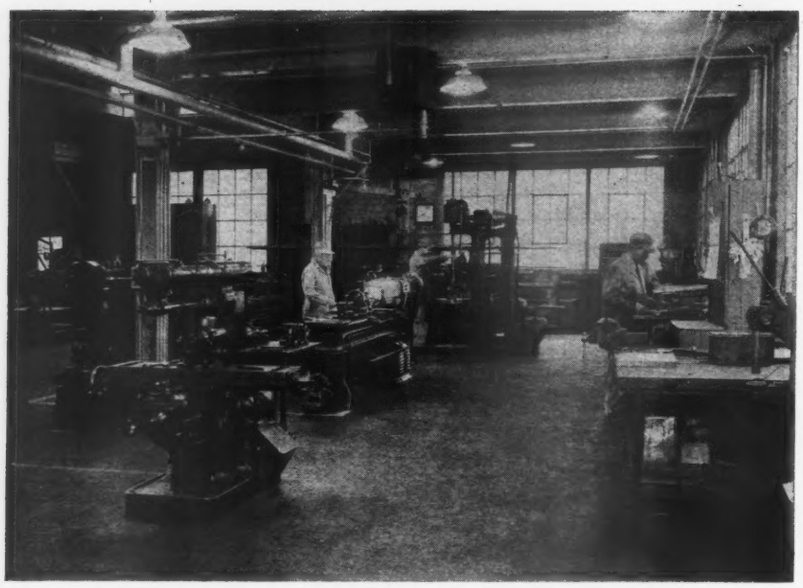
The machine shop not only handles routine repairs and operations, but in this department there have been designed, developed, and patented several important items of equipment pertinent to our industry. In addition, other equipment has been redesigned in order to make it serve our needs to better advantage.

In general, then, the work of the maintenance department involves:

1. Inspection of machinery at frequent and regular intervals to detect maladjustments, wear, or impending breakdown.
2. Making of emergency repairs and those found necessary on inspection.
3. Keeping complete inventory records of all equipment and spare parts, with a record of repairs or changes.
4. Keeping tickler records covering reinspection.
5. Keeping records of the life of materials used on certain portions of fast-wearing equipment.
6. Proper classification of maintenance and repairs against replacements and items which add to capital expenditure.
7. Preparation of cost estimates of work requested.
8. Maintaining office records and reports on plant improvement.

Frequent and thorough inspection is one of the foundation stones of protective or preventive maintenance. Each foreman is therefore required to make his own inspection of the plant at least every 30 days.

If he sees any condition that affects another trade, he makes a memorandum which is brought to the plant engineer's attention. The chief responsibility of each division is to do the best piece of work possible, to see that it is



Maintenance department's toolroom, on first floor of Service Building, is equipped with all needed tools and repair parts

done economically, and within the budget. Literally this set-up not only makes each department and each craft a separate little unit or company, but also places the responsibility for workmanship and the quality of material, as well as costs, upon that division.

Regular Inspections

All plant buildings are inspected regularly by one of our men who is a graduate structural engineer. His inspection is made every six months. He notes the condition of the roofs, ventilators, sash, brickwork, caulking, and all other elements. His report is turned in to the plant engineer's office where it is analyzed and work orders made out for the different trades.

The supervisor working with the engineers, oilers, and electricians keeps under continuous inspection all the moving equipment in the plant. It is also his responsibility to keep the oiling records up to date. As he goes about this work in a systematic, orderly way, he notices any points where valves may be leaking or coverings broken on pipes, say, and makes notations of any other conditions which should receive the attention of the maintenance department.

Electrical inspection likewise is governed largely by the card system. Motors operating under high-temperature conditions are cleaned, have the bearings washed, and are generally overhauled at intervals which our experience shows are suitable. In addition, each of the electricians on the various shifts is definitely responsible for certain motor groupings.

In other words, the electrician working on the day shift is responsible on his first Sunday for seeing that all the motors in that particular group are cleaned, the bearings washed, and the controls checked. Thus his Sunday work often requires not only all his own time, but the assistance of another electrician.

Our protective maintenance procedure pays because we have inspired our men with a feeling of responsibility for their particular craft as well as the equipment for which they are responsible. Any one of the millwrights who are responsible for the conveyors in the Bottling Building, say, would feel disgraced if a belt should break, bearing go out, or gear reducer fail during the following week, because they have been paid to make that inspection on Sunday and they realize that that equipment is their responsibility. The same may be said of the other trades in the maintenance department.

We consider the subject of maintenance not only as it applies to repairs and replacement, but have endeavored to guard against waste. We have proved that another profit may be derived, for the management, in the matter of salvage. The item of scrap salvaged amounts to hundreds of dollars saved each year.

One other important function of this department is the conduct of safety activities. Organized under our maintenance supervisor is an emergency squad which has charge of a modern inhalator as part of our first-aid equipment. Training has been given our men in the use of this equipment, as well as gas masks. The same group of men are also important members of a well-organized fire-fighting squad.

There are a good many men in the maintenance department, and a large amount of work is handled, but we believe it is done with a minimum of red tape consistent with orderly and close control of activities and costs. All work done must be covered by a written work order card. This is necessary to show that the supervisor of the department is familiar with the work required and recognizes the fact that an item of cost has been incurred for which he is responsible.

When a department head has to have work done by the maintenance department, he fills out the form shown in Figure 2. The lower half of the card is for work done by outside contractors. On the back of the card are spaces for recording the time, date, name of workman, and cost. This information is taken from the card which Figure 3 shows.

When the work order has been received and approved by the superintendent and plant engineer it is given a consecutive number referring to the location in the plant where the work will be done. That is, each building is designated by a letter. For example "B" refers to the Bottling Building.

Red for Sunday

The job number follows last previous job. The craft involved is also designated by a letter. For example "S" refers to steamfitters. Therefore, a pipe repair job in the Bottling Building would be numbered "B 262 S", if the previous job, regardless of craft, were numbered 261. A red card identical with Figure 2 in all other respects is used exclusively for work to be performed on Sunday, or jobs that cannot be done during the regular working hours of the plant.

Then Figure 4 is made out and issued to the craft or crafts which are to perform the work. The craft records all material required for each job on the back of the card. The amounts should check closely with those shown on an estimate sheet which is made up before the job is started. When the work has been completed, this card is returned to the maintenance department office and all material itemized and transferred to the card which Figure 2 shows.

A time clock system is used for recording the activities of all plant employees. In the maintenance department each man makes out his own card, Figure 3, which is approved at the end of the day by the craft foreman and checked by the timekeeper against the payroll card.

(Continued on page 120)

Phone Systems Within the Plant

Easy communication is a "must". A private telephone system may give better service for less money

FREDERICK SMITH
J. O. Oliver & Company, Inc.
New York

THERE ARE many electrical and mechanical aids to management, but few contribute more to economy and efficiency than does a modern system of intercommunicating telephones. In factories, business offices, and establishments of all kinds, a dependable means of direct communication between executives and subordinates, and from department to department, saves time, eliminates lost motion, and permits the handling of routine matters with precision and dispatch.

In every business organization the first consideration for telephone communication is naturally that of providing proper facilities for service with the outside world. This invariably necessitates the rental of a manually operated switchboard with one or more trunk lines to the city system, and such extension telephones as may be necessary throughout the plant.

These facilities are also available for communication between stations within the organization, but the effect of this additional traffic is frequently to create interference between city and interstation calls, and to divide the attention of the operator to the detriment of the service.

For Local Calls

As much as 75 per cent of the traffic clearing through a switchboard may represent calls from station to station within the organization, while the remaining 25 per cent is divided between incoming and outgoing calls over the city system. It can readily be seen, therefore, how an auxiliary system of direct communication between key points within the plant will not only serve to relieve the switchboard and operator of a considerable part of this traffic load, but also improve the service over the trunk lines by reducing the waiting time consumed in holding city calls for stations engaged in interdepartment conversations.

A solution to this problem that will make for maximum efficiency at lowest operating cost is to eliminate from the rented system those telephones that are not required for service outside the organization, and install an auxiliary privately owned system for direct, station-to-station communication.

In addition to the savings immediately effected by the elimination of these rented extension stations, further savings are often possible by cutting down the number of trunk lines as a result of the reduced traffic, and by reducing the cost of excess messages through the elimination of personal calls.

Other advantages of a privately-owned system are the fact that intercommunicating service is available after regular office hours when the switchboard operator has gone for the day, and the convenience of being able to talk privately to any member of the organization while someone waits on the outside telephone for an answer.

There are several types of intercommunicating telephones available with which both the initial and maintenance costs are very low. These equipments vary all the way from a simple two-station, private-line system to a complete, private, automatic-exchange dial system of 100 or more stations. The instruments available range from the conventional wall or desk telephone to the recently introduced electronic loudspeaker type. The latter are a development of the radio industry. They are capable of giving excellent service in private offices and other locations where the conversation will not be disturbing to others, but they are not always adapted to the wide range of use to which the conventional, low-voice type of instrument may be put. Particular uses for this type of apparatus will be covered in a later article.

A simple method of determining where and how large an intercommunicating telephone system may be used to advantage in any organization is to make a chart similar to that shown in Figure 1. The various locations at which intercommunicating stations will probably be required

INTERCOMMUNICATING TELEPHONE SYSTEM
SERVICE CHART

Calling Stations		Stations Called 1	2	3	4	5	6	7	8	9	10	11	24	25
Gen. manager	1		✓	✓	✓	✓	✓	✓	✓	✓				
Sales manager	2	✓		✓	✓	✓	✓	✓	✓	✓				
Bookkeeper	3	✓	✓		✓	✓	✓	✓	✓	✓				
Superintendant	4	✓	✓	✓		✓	✓	✓	✓	✓				
Production dept.	5	✓	✓	✓	✓		✓	✓	✓	✓				
Assembly dept	6			✓	✓	✓		✓	✓	✓				
Stockroom	7			✓	✓	✓	✓		✓	✓				
Shipping dept	8	✓	✓	✓	✓	✓	✓	✓		✓				
Warehouse	9			✓	✓	✓	✓	✓	✓					
	10													
	24													
	25													

Figure 1. If the chart shows that some stations will not need to call all others, a somewhat less expensive instrument can be installed. Here three departments will be served adequately by a six-button telephone; the others require an eight-button unit.

are first listed vertically and designated by a number. A horizontal row of check marks is then made in the spaces corresponding to the numbers of the stations most frequently called. In this way the required calling capacity of each station is easily ascertained and from these data the type and size of system needed by the organization can be arrived at.

The chart in Figure 1 illustrates conditions typical of a small manufacturing plant in which the requirements for connection with the city telephone system would be approximately six telephones, necessitating a cordless branch exchange switchboard with a minimum of two city line trunks. In addition there are three locations—assembly department, stockroom, and warehouse—that do not require outside service, but nevertheless are important points for inside intercommunicating service. It will further be seen that to provide means for full intercommunication would require an auxiliary system having facilities for calling only eight other points.

Table I lists the various types of service that have been standardized by the leading manufacturers of intercommunicating telephones, with the practical range in the number of stations for each type of system. From this table it will be seen that the conditions indicated in Figure 1 can be met either by a selective-ringing, common-talking system with an ultimate capacity of nine stations, or a selective-ringing, selective-talking system which would have an ultimate capacity of twelve stations.

TABLE I. INTERCOMMUNICATING TELEPHONE SYSTEMS

Type of System	Application	Capacity, Stations	Approximate Installed Cost per Station
1. Two-station, private line	Isolated locations, such as between office and warehouse.	2 only	$50– $60
2. Code-ringing, common-talking.	Party-line service. Bells at all stations ring. Suitable for light traffic, as between floors of warehouse.	3– 6	$40– $50
3. Master and outlying stations, common talking. Only master can call.	Department head to assistants, guard's office to watchmen, elevator dispatching.	4– 12	$45– $55
4. Master and outlying stations, selective talking. Only master can call.	Executive to subordinates, where confidential service is desired.	4– 24	$60– $75
5. Selective-ringing, common-talking.	Direct, station-to-station service where traffic is light. Limited to one conversation at a time.	4– 9	$50– $60
6. Selective-ringing, selective-talking.	Direct, station to-station service where several conversations must take place simultaneously.	6– 25	$80–$100
7. Private automatic exchange.	Direct communication with dial-calling through an automatic switchboard. All conversations confidential	10–100 or more	$100–$150

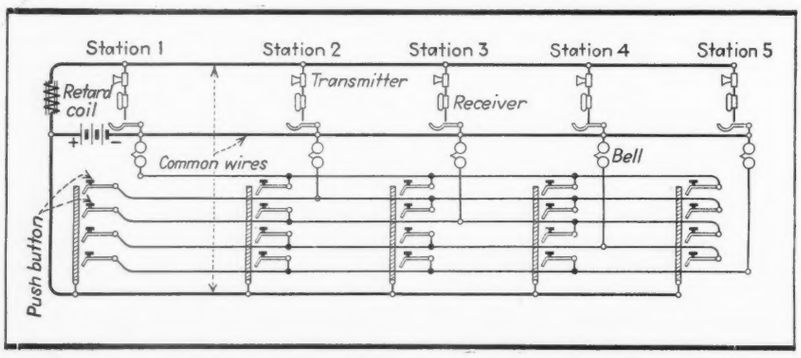


Figure 2. Schematic wiring diagram of a selective-ringing, common-talking telephone system comprising five stations. Wiring consists of three conductors common to all stations, and one individual wire for each station—in this instance a total of eight wires

Private, and Not So Private

To avoid confusion it will be well to explain the meaning of certain terms used in the preceding paragraph and in the table. For example, a "code-ringing" system is one in which the bells at all stations ring when the button at any station is pushed. Each station must then be identified by a certain number of short rings, or by some combination of long and short rings.

With a "common-talking" system the conversation between any two stations can be heard by any or all other stations merely by taking the receiver off the hook. In other words, there is no assured privacy of conversation. Naturally, only one conversation can be handled at one time, by the system.

A "selective-ringing" system is one in which only the bell at the desired station rings when the button at any calling station is pushed.

Similarly, "selective-talking" means that independent conversations can take place between several pairs of stations at the same time, without interference.

For the company whose communication requirements are shown in Figure 1, a selective-ringing, common-talking system would answer the purpose, since in all probability the traffic conditions will be light. Furthermore, the cost of a system of this type will be about half that of a system arranged for full selective-ringing and selective-talking service.

In this and any similar case the only other factor to be considered is whether it is likely that the plant will grow to any appreciable extent in the near future. If considerable expansion is likely to take place, the additional cost of a full selective-ringing and selective-talking system having an ultimate capacity of twelve stations might be justified, since the practical limit of a common-talking system is about nine stations. When a system of more than nine stations is required it is highly probably that traffic conditions will be such as to require more than two conversations to take place at the same time.

As will be seen from the schematic wiring diagram, Figure 2, the common-talking circuit is a bridged arrangement of the receivers and transmitters of all telephones, which are operated from a central source of power. Current at 6-9 volts for ringing and talking may be supplied from a battery of four to six dry

(Continued on page 120)

Better Packing, Less Damage

Rough handling of shipments can't always be avoided, but careful study of requirements will show how you can reduce risk of damage, and maybe save money, too

G. A. VAN BRUNT
Associate Editor

IN ANY well-managed plant, every detail of the manufacturing processes, inspection, and handling is under more or less continuous scrutiny. Not much is left to chance, and every opportunity to save a penny here or a fraction of a cent there is likely to be exploited to the full. All this care and attention are exercised right up to the time the product leaves final inspection and goes to the shipping department. At this point it enters a zone where in many instances scant attention is paid by management to the methods and materials used in the highly important operation of preparing the product for shipment.

That is an important operation because the condition in which the shipment will be received depends on the methods used to protect it during transportation, and the skill that has been exercised in applying them. And since there are endless opportunities to use inadequate or unnecessarily costly methods, a complete study of the requirements and how they can best be met, will frequently show how better results can be obtained at a worth-while saving.

Strap for Strength

Different methods and materials have been developed for protecting during shipment the virtually infinite variety of products that flow from industry's plants to consumers. Corrugated fiber containers, and strong, waterproof paper, for example, find wide and increasing use because they are ideal for many purposes. However, wooden boxes and crates are the real patriarchs among protective coverings, and it seems likely that they will continue to be indispensable for a long time to come. In fact, the usefulness of wood as the basic material for protective inclosures has been considerably increased by the large amount of study that has been put on the methods of constructing and strengthening them.

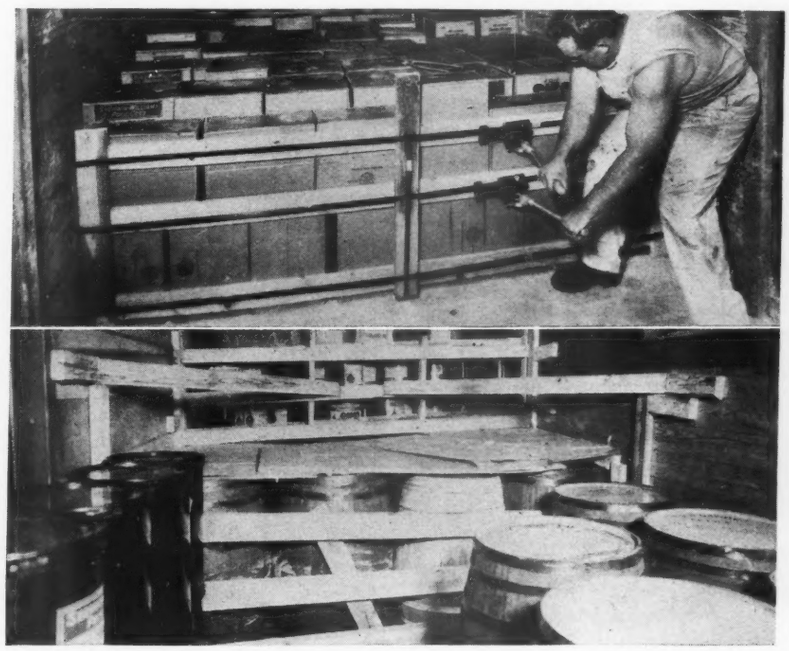
Nails are the simplest and cheapest means that have been developed for holding boxes and crates together, but they have their limitations. Boxes inevitably are subjected to all kinds of rough handling, bumps, and stresses in the journey that begins when they are nailed together in the manufacturer's shipping department and ends when they are knocked apart in the purchaser's receiving department.

With ordinary wooden boxes, twisting and bending stresses of any real magnitude invariably result in more or less serious loosening of the nails and consequent weakening of the entire structure. Depending on the kind, quality, and condition of the wood, severe shocks are likely to result in some splitting of the wood, particularly at the nail holes, and possibly extensive breakage. In any event, the protective value of the box is impaired or destroyed, and the contents may be lost or damaged.

The solution of such troubles is often sought in the use of thicker sections of a better quality of wood, cleats, or braces, and closer spacing of nails. These means are likely to be more or less successful, but they entail more labor, increased material costs, and higher shipping charges.

Research and practical experience have shown that wooden boxes or crates can be strengthened considerably by binding them together at certain points with thin steel strap or wire, in much the same manner that one ties a package with a string. Steel bands or straps may be nailed in place around the extreme ends of the box. When so used they act as a cleat, increasing the rigidity and resistance to any skewing or weaving action of the box, and tend to prevent the nails from pulling out of the ends.

Nailless strapping is drawn up by means of a hand-operated device tightly enough to cut into the edges of the box, and the ends are joined by some form of seal that locks them



A few steel straps binding a shipment into a compact unit are easier to apply and more effective in protecting it from damage than timber bracing

in place and prevents slipping. When only one strap is used, it is placed around the center of the box on the small diameter; that is, perpendicular to the grain of the wood in the top, sides, and bottom. If two straps are used, they are placed a distance from the ends equal to about one-sixth the length of the box. Additional straps, when used, are spaced equally between these two.

Placing straps some distance from the ends of the box has the effect of distributing shocks that would otherwise be absorbed locally. As a result, direct pull on the nails is reduced, and splitting or breaking of the wood is lessened. In consequence of this strengthening effect it is frequently possible to use cheaper or thinner wood without materially sacrificing protection for the contents of the box.

In many instances it has been found possible to substitute crating for boxes, by redesigning the latter so that entire boards in certain places can be left out. Development during the past few years of waterproof paper having exceptional strength has also helped to make some of these changes feasible.

Put Straps in Proper Places

For example, a manufacturer of a certain type of railroad equipment was able to cut the cost of a box for one important item by 40 per cent and at the same time practically eliminate the trouble formerly experienced from rusting. This piece of equipment, which weighs several hundred pounds, was formerly packed in a strong and tight box. Oftentimes the boxed parts remained for some time in storage, or were left on some shipping platform until needed. Changes in temperature and humidity, and possibly exposure to rain, often resulted in condensation of moisture on some of the machined surfaces and other parts, with subsequent rusting.

A steel-strapped crate was substituted for the box, and the practice of wrapping the equipment in a strong waterproof paper was adopted. The crate costs about 40 per cent less than the box formerly used and, probably because ventilation is better, no further trouble has been experienced with rusting.

In addition to these advantages, there was a worth-while saving in freight charges by reason of the considerably reduced weight of the crates, as compared with the box formerly used.

Other examples of the savings that have been made through better design and reinforcing of boxes will be found in the illustrations on these pages.

There are a great many products that do not need to be put in boxes or crates for protection. Oftentimes the individual unit is of moderate size, and an average shipment will consist of a considerable number of pieces or units. Familiar examples of such products are metal ingots, brick, pipe or tubing, metal sheets, and so on. Of recent years, the practice of strapping a number of such units to a skid has come into favor. These skids can easily be handled by fork trucks.

Solid But Flexible

With any products that lend themselves to handling in this way, there may be good opportunities to make important savings. Skids cost little to make, can usually be used over and over again, and in view of their lightness they add only a negligible amount to the weight of a shipment. The cost of packing materials is slight, while the labor expense of applying and removing pads or separators is trifling.

The problem of safe and economical shipment does not end when the product is put into a box or crate, or strapped on a skid. It must still be loaded into a truck or freight car. A problem of long standing, when shipments are made by freight, is concerned with the question of how the load can best be braced in the car. Freight cars necessarily get rather rough handling, and usually it is necessary or desirable to prevent excessive movement of the contents, in order to prevent damage.

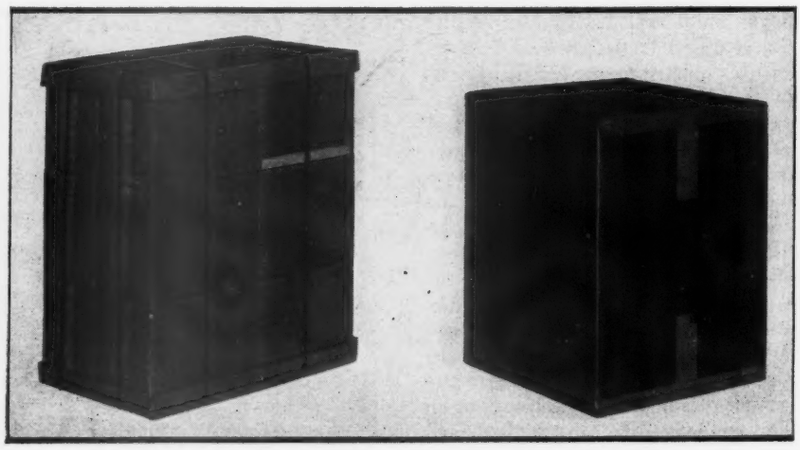
Customary practice has been to lock and brace shipments with timbers nailed to the sides and bottom of the car. When properly carried out, this method of protecting shipments may be effective enough, but it is expensive under any circumstances. The lumber and the cost of installation frequently amount to a considerable sum, while freight bills are increased because of the extra weight.

Many manufacturers have reduced these costs markedly by adopting steel straps for bracing shipments. Many factors must be taken into consideration in working out the most effective way of using steel straps under the wide variety of conditions encountered, but two general procedures are followed.

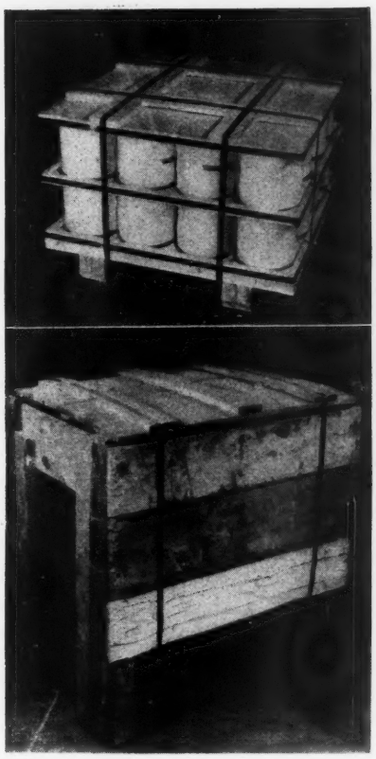
1. All or a number of the boxes, crates or other components that comprise a shipment are tightly bound together by one or more heavy steel straps into a compact unit. Such a unit is free to move slightly under heavy impacts, but normally the weight of the unit and the high coefficient of friction between it and the car floor are sufficient to limit the movement to a few inches at most. At the same time there is enough flexibility in the unit as a whole to allow the individual elements to shift slightly and thus help to dissipate shock.

2. With some types of shipments it is considered desirable to have individual units, or those formed by tying separate packages together, firmly anchored in place. This is accomplished by means of heavy clips which are securely nailed to the floor or sides of the car. The steel strap that braces the load is then securely locked in these clips.

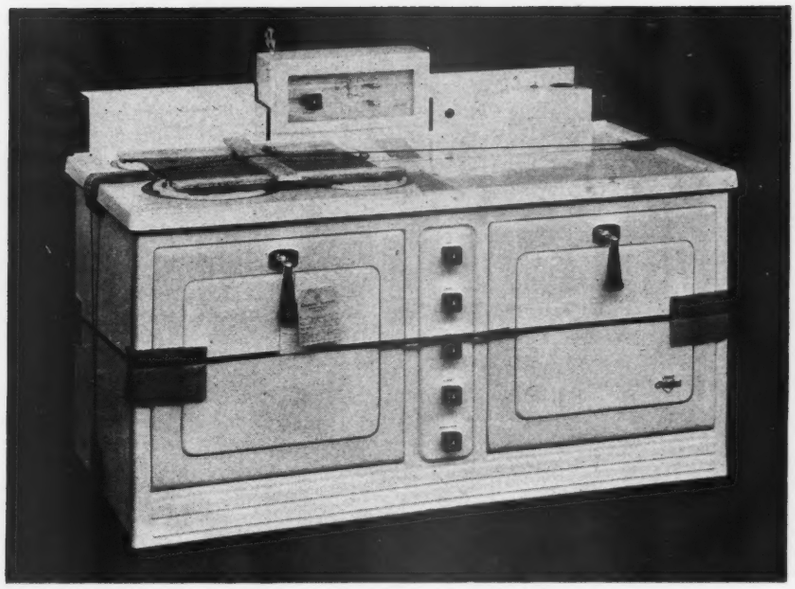
With either method, unloading a car becomes simply a matter of cutting the straps, and removing the packages in whatever way is suitable.



A popular-priced make of electric grill was packed in individual cartons and shipped in dozen lots in a large outer carton. Use of steel straps permitted dispensing with the outer carton, cut cost 10 cents per dozen lot

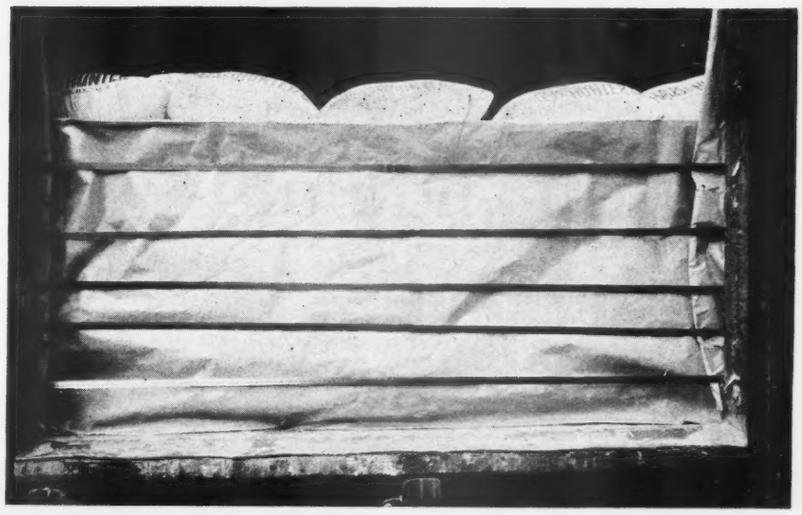


Copper wire on spools was formerly shipped in crates, shown in the lower view. They were replaced with skids at an estimated saving of $2 per skid. The new skid is 95 lb. lighter

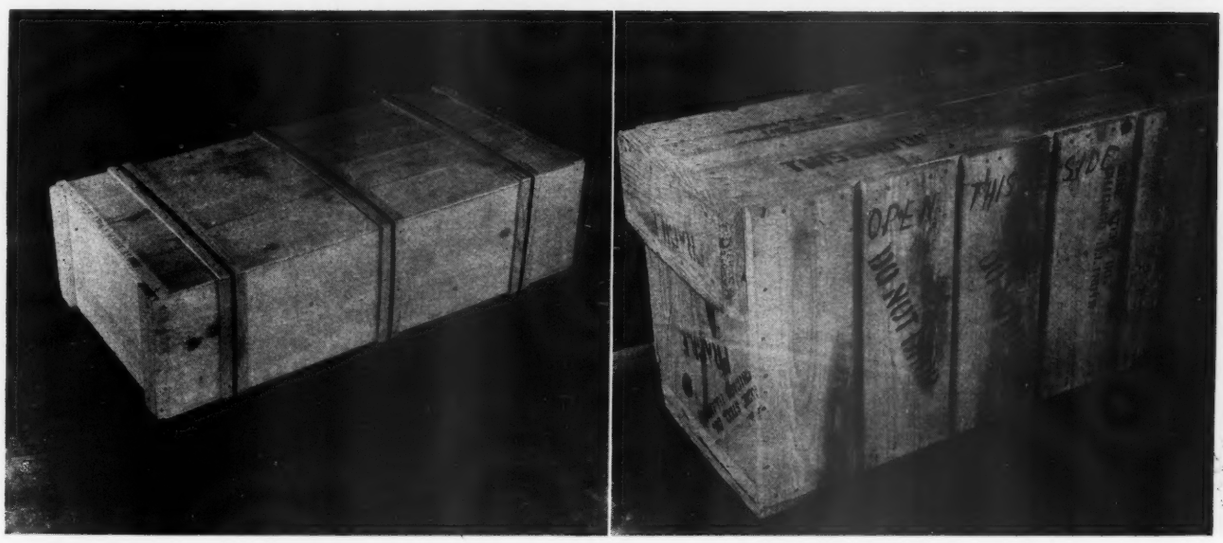


A manufacturer of high-grade electric ranges had the problem of keeping doors and drawers shut, and heating elements in place, during shipment. Steel strapping reduced time required by previous method 33 per cent, with more than 4 per cent saving in material cost, and less marring of the finish

So-called anchor strap provided with holes at half-inch intervals offers several advantages and is finding increasing application in bracing shipments of all kinds at freight car doors



To protect building tile it was shipped in a box made in part of 2-in. lumber, weighing almost as much as the contents. Redesign reduced total shipping costs 2.2 cents per unit tile



New hood does not interfere with handling racks of steel, is more effective than old arrangement

Push-and-Pull Fume Removal

Pickling produces corrosive fumes — a serious problem until good engineering worked out a way to eliminate them

CHARLES L. WILLIAMS
Engineer of Methods and Equipment
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Detroit

MANUFACTURE of an automobile wheel starts with the pickling of the steel from which it is made. This process consists in immersing the steel in a 6 per cent solution of sulphuric acid which is steam-heated to about 200 deg. F., the heat accelerating the chemical action of the acid. Removing the mill scale requires about 15 min. under these conditions.

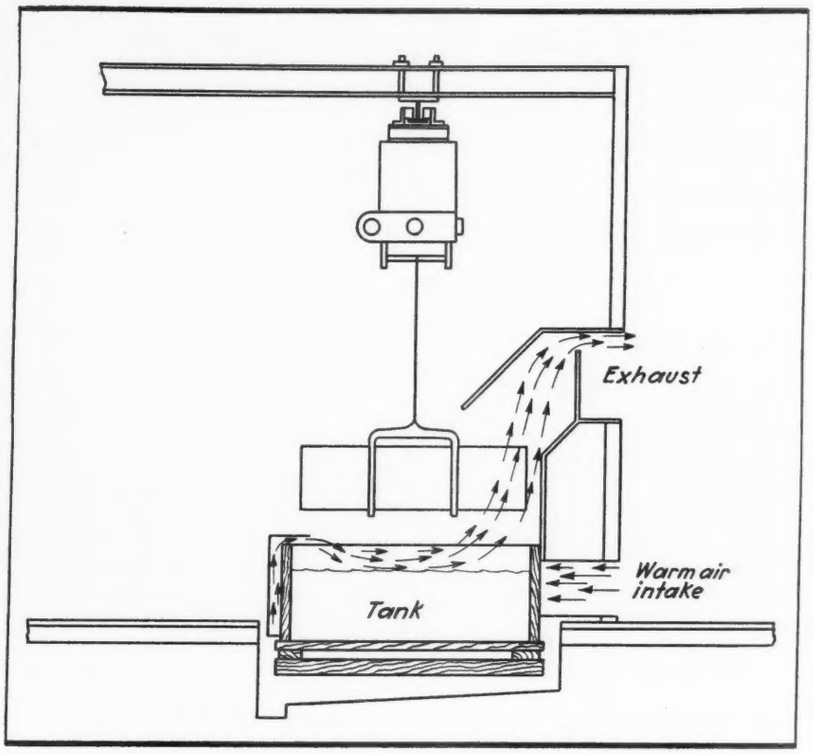
Chemical action of the acid on the steel liberates quantities of hydrogen gas which, in the form of bubbles, continuously rises to the surface, carrying with it quantities of the acid. The result is a large volume of fumes which are destructive to building and equipment, and constitute a source of serious discomfort to the men.

We gave this problem serious thought and devised many schemes to improve conditions before hitting on the method of fume removal that was installed several months ago. Basically, the idea is to push and pull the fumes at the same time, so that complete elimination is now secured. Since pickling is a common operation in industry, a description of our method of removing fumes may be helpful.

The exhaust hood, instead of covering the whole operation as formerly, now projects 1½ ft. over the ends of the tanks. This abbreviated hood is made of 2-in. plank and is so constructed that no part of the steel supports is exposed to the fumes. The entire structure is protected by acid-resisting paint.

A wall of planking at the ends of the tanks extends to the floor. A 3-in. slot is left at the top of this structure through which the fumes are exhausted to the stacks. However, this space is partially closed by an adjustable board screwed to this back wall, which permits uniform suction from the exhaust fans through the 100-ft. length of hood. Near the outlet to the stack, for example, this opening is only 1½ in. in width, whereas at the ends the full width of 3 in. is allowed.

Located on a platform at the rear of the hood, but equidistant from each end, are two 50,000-c.f.m. exhaust fans protected on the inside by a rubber coating and driven by 20-hp. motors. The intake of each fan is connected to a wooden duct which is uniformly tapered in cross-sectional area from the center to the ends of the hood. This variation in size is, of course, to accommodate the increas-



A blast of warm air blown across the surface of the tanks carries fumes to the back and up into the exhaust hood

ing volume of air to be handled throughout the duct length.

The 3-in. slot just mentioned connects the hood to the suction duct. The exhaust of each fan passes through a leg of a large monel metal Y connected to the bottom of the stack. This exhaust stack is round and is constructed of wooden staves with hoops around the outside. With this construction no metal is exposed to the fumes, and the wood is kept well painted with acidproof paint.

The stack is supported by structural steel framework high enough above the exhaust fans so that the angle at which the monel metal ducts from the two fans enter the bottom of the stack is so slight as to cause very little frictional loss. Of course, the stack extends far enough above the building roof to avoid any down-draft air currents.

Blown into the Hood

Although the exhaust system removes 100,000 c.f.m. of air with a velocity from the hood of 4,000 f.p.m. the resultant suction is not sufficient to collect and remove all the acid fumes.

Our experience indicates that these fumes must be controlled at all times if they are to be collected properly. If permitted to rise naturally, they mix readily with the air above the tanks with the result that a tremendous volume of air and fumes would have to be removed from the building, with consequent great loss of heat. Power costs under these conditions would also be excessive by reason of the large exhaust fans needed.

To prevent the fumes from rising above the top of the tanks a blanket of hot air is blown at high velocity over the entire surface of each tank from the front toward the back. This high-velocity, hot air blanket carries all fumes and vapor rising from the tanks along with it toward the rear, at which point they lose velocity and rise naturally under the exhaust hood which extends only 1½ ft. over the rear of the tanks.

Here the suction from the two exhaust fans picks up the fumes so that none escapes to the atmosphere of the shop. In other words, the fumes are pushed over to the hood where they can be pulled out.

Why Hot Air Is Used

Hot air is used not only to avoid cooling the liquid in the tanks, but also because it tends to rise thus preventing a large volume of colder room air from entering the system and being exhausted by the fans. This air, at a temperature of 140 deg. F., is supplied at a velocity of 4,000 f.p.m. by two 8,000-c.f.m. fans, each driven by a 5-hp. motor. They draw air at room temperature through steam-heated coils.

These fans and air heaters, together with the exhaust fans, are located behind the hood in order to provide a clear working space at the front of the tanks for the material handling necessary in the pickling operation. The hot air is discharged from these fans into a rectangular tunnel duct running between two pickle tanks to the front where it divides into two sections, one going each way along the front of the tanks. Each section is 25 ft. in length and is attached to the front edge of the tanks. Two of these duct systems are provided, each serving half of the tank length of 100 feet.

As in the exhaust duct, these hot air ducts are uniformly tapered in cross-sectional area from the tunnel duct to the end of each branch duct. They have a uniform width of 7 in. These 25-ft. sectional ducts are extended about 5 in. over the ends of

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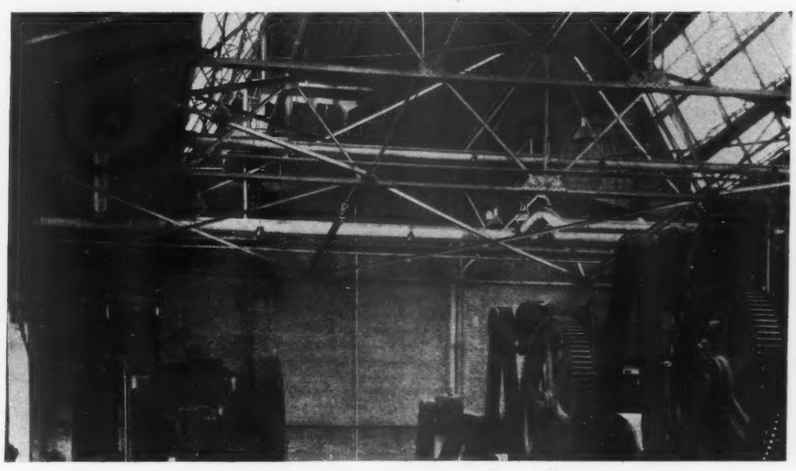

One of the three air heaters that supply warm air to replace that removed by the acid fume exhaust system

Watch Insulation Resistance

It's easy enough to measure, but if you don't take account of certain factors the results may be of little value, and often lead to wrong conclusions

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RELATIVE insulation resistance of an electrical machine is an excellent indication of the "health" of the insulation. To interpret properly the relative values of insulation resistance, various factors must be known and evaluated. There are only a few of these factors, but unfortunately even these few are too often neglected. The result is chaotic data on insulation resistance which are not only a poor guide but lead to erroneous conclusions.

Insulation in general is often referred to as "second-class conductors," because all insulation is conducting to some degree, although with most insulators the conductivity is so slight that it is forgotten or disregarded. For example, copper has a resistivity of 0.00000067879 ohms per inch cube, whereas mica has 3 to 50 million megohms resistivity per inch cube. Thus the relative insulation resistance of mica as compared to copper is roughly one billion multiplied by ten billion or 10^{19}. The point to be remembered is that insulation is conducting, regardless of how small the conducted current is.

The same laws of current flow apply to both conductors and insulators. To illustrate this point, Ohm's law states that volts divided by ohms resistance is equal to current flow in amperes. This law applies equally to current flow through insulation. For example, a 500-volt machine with 100 megohms insulation will have a leakage current to ground of 5 micro-amperes.

As Temperature Rises

The particular characteristic in which second-class conductors (insulators) differ from first-class conductors is in the effect of temperature on their resistance. First-class conductors increase in resistance slowly as the temperature increases, whereas second-class conductors decrease in resistance rapidly as the temperature increases. Different insulating materials change their resistance in varying degrees with temperature, but all decrease in resistance rapidly as the temperature rises.

Figure 2 shows a typical curve of insulation resistance plotted against temperature, for an induction motor with Class A insulation. In Figure 3 are shown similar data for a railway motor with Class B insulation. From these curves it is clear that insulation resistance varies widely with temperature. Therefore, unless the temperature is known, as well as the insulation resistance, different values of the latter are not comparable and are of no practical use.

In order to use insulation resistance measurements on a particular machine as a measuring stick, they must all be made at the same temperature or a common basis for temperature comparison provided. Since even a small change in temperature makes a great difference in insulation resistance, it is preferable to establish a curve of insulation resistance against temperature.

To do this, a typical machine should be selected which is known to be in good condition and thoroughly dry. Insulation resistance measurements should then be taken at several different temperatures and a curve made as in Figure 2. These results establish the slope of the curve. Drawn on semi-log paper it should be a straight line. The safe upper and lower limits can then be drawn as parallel curves, as shown.

Beware of Moisture

It is of the utmost importance to take insulation resistance measurements at a time when moisture conditions are stable. Data should not be taken while the apparatus is being dried out, because they will have no comparative value.

The following formula for calculating the effect of temperature on insulation resistance is useful in determining the approximate slope of

Figure 1. After the angry waters have subsided. An insulation resistance meter plays an important part in the maintenance department's fussy job of restoring flooded motors to service

Temperature Limits and Insulation Resistance-Temperature Constants

Class	Material Classification: General	Material Classification: Examples	Limiting Observable Temperatures, Deg. C.: Industrial Apparatus: By Therm.	Industrial Apparatus: By Resis.	Transportation Apparatus: By Therm.	Transportation Apparatus: By Resis.	Insulation Resistance Constant, per 10 deg. C.
A	*Organic (impregnated)*	Cotton, silk, paper, fullerboard, enamel	90	95	120	140	44 per cent
B	*Inorganic (impregnated)*	Mica, asbestos, glass	110	115	145	170	63 per cent

the curve from a single measurement:

$$R = rC^n$$

Where;

R = Insulation resistance at higher temperature (T deg. C.)

r = Insulation resistance at lower temperature (t deg. C.)

C = Constant
For Class A insulation 0.44
For Class B insulation 0.63

n = Exponent $(T^\circ - t^\circ) \div 10$

T = Higher temperature, degrees C.

t = Lower temperature, degrees C.

For example, assume that a motor has an insulation resistance of 5.2 megohms (r) at 30 deg. C. To find its insulation resistance (R) at 50 deg. C.:

$R = rC^n = 5.2 \times (0.44)^2 = 1$ megohm, because

$n = (T^\circ - t^\circ) \div 10 = (50 - 30) \div 10 = 2$

It is recommended by the American Institute of Electrical Engineers that the insulation resistance of stator windings and armatures of clean, dry machines at approximately 75 deg. C. should not usually be less than given by the formula:

Insulation Resistance, Megohms = Rated voltage of machine ÷ (Rating in Kva. ÷ 100) + 1,000)

General Practice

Minimum insulation resistance of the field should be on the order of 0.5 to 1 megohm, depending on the size of the machine. It is the rather general practice of insurance companies to demand an insulation resistance of 1 megohm per 1,000 volts operating voltage, with a minimum of 1 megohm, for insured apparatus.

The curve in Figure 4 shows graphically the insulation resistance values recommended as minimum at 75 deg. C. by the A.I.E.E., under the formula given above. It should be noted that with this formula voltage is the principal factor in the smaller ratings.

There are four common methods of measuring insulation resistance:

1. Wheatstone bridge method.
2. Insulation resistance meter method.
3. Voltmeter method.
4. Volt-ampere method.

Whichever method and voltage are selected should be used consistently for comparative results. For general usage the second method is the most convenient and accurate.

Method 1 is useful only for resistances of less than 1 megohm and is undesirable in most instances because of the very low test voltage applied.

Method 2 is reasonably accurate within the limits of the meter scale range. The portable test outfit used does not require an outside voltage source, applies a sufficiently high voltage to give an indication comparable with service conditions, and is direct-reading.

Method 3 requires an outside d.c. voltage source. The procedure is to

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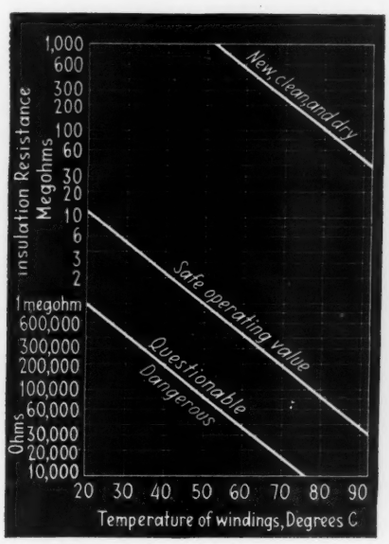

Figure 2. Resistance drops as temperature rises. Curves apply to a.c. induction motors, Class A insulation

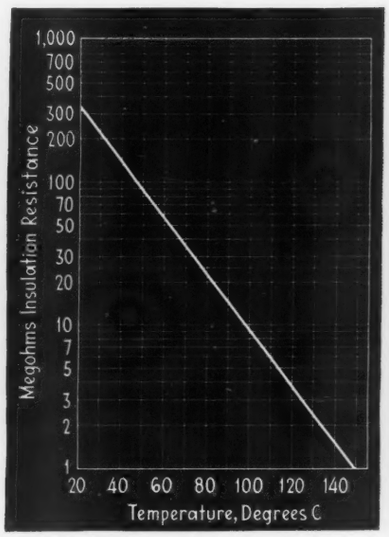

Figure 3. Effect of temperature on the insulation resistance of a traction motor with Class B insulation

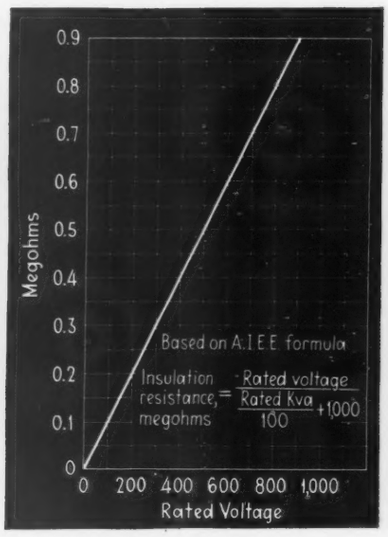

Figure 4. Minimum resistance at 75 deg. C. for motors and generators rated 1,000 kw. (kva.) or less

Industry Lighting Studies

5. Candy

Fifth of the Illuminating Engineering Society's studies. Candy manufacturing is not unlike other industries—most operations require good lighting properly directed. Here are recommended levels

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Engineering Publications
Nela Park Engineering Department
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MUCH OF THE PRODUCTION in candy manufacturing plants is seasonal, and lighting must be designed to insure satisfactory operation during these peak production periods. Also, lighting must be adequate to promote cleanliness, facilitate labor supervision, and minimize the accident hazard of the intricate automatic machinery used, which is composed of rapidly moving parts, sharp knives, and dies.

Now there are a great many widely different kinds of candy, so it is only natural that we should find equally wide variances in the sequence of manufacturing processes or operations. In the ensuing discussion, therefore, each process or operation will be treated individually, with utter disregard for the particular order in which it may occur in a given candy-making establishment.

Crushing Machines

Purpose of these machines is to press out from cocoa beans their high content of butter or fat. It is collected in containers and separately conveyed with the crushed beans to the mills or refineries where the bean is pulverized and the fibers are broken down to their semi-final stage.

Here powdered milk and sugar are added and the mixture is then conveyed to the final milling. A minimum of 10 foot-candles of well-diffused illumination is recommended for this operation.

Conche Machine

This machine mixes the preparation made by the crushing machines along with cocoa butter. From it the mixed chocolate liquid is taken to the various dipping sections. These operations are not difficult from a seeing standpoint, because practically all of them are confined to the inside of hoppers, refiners, and other candy-making equipment of similar nature.

Ten foot-candles of illumination is recommended for chocolate processing sections.

However, at the 5-roll mill where the original preparation is pressed, a level of at least 25 foot-candles is required for setting the rolls. This level of illumination can be provided by supplementary lighting units. Figure 1 shows how light must be directed for proper illumination of a candy refiner.

Cream Making

Let us now consider fillings and what their manufacture needs in the way of artificial illumination.

The base for creams and filling, usually glucose, is slowly cooked in copper vats, after which it is drawn through coolers to large tubs and beaten with paddles. Another vat then receives it and there it is remelted and recooked to increase the viscosity. Following this operation flavoring is added and the entire mass is withdrawn in tubs and mixed thoroughly. From here it is taken to the molds where the filling is forced into them under pressure.

There is no critical seeing task involved in cream making and measurements indicate that 20 foot-candles of illumination will provide a perfectly good seeing environment.

Chocolate Dipping

Dipping is carried on in various sections of the plant. The dipping tables are usually located symmetrically, with the operator sitting beside a depressed section of the table. The fillings are on wax paper trays on her left, the work slab in front, and the melted chocolate which is kept pliable by heat, on her right.

Although the visual task is not extremely severe, the operator is required to see the relative drippings from the hand over the confection in order to make a neat and orderly design. Therefore a minimum of 20 foot-candles of well-diffused general lighting is required.

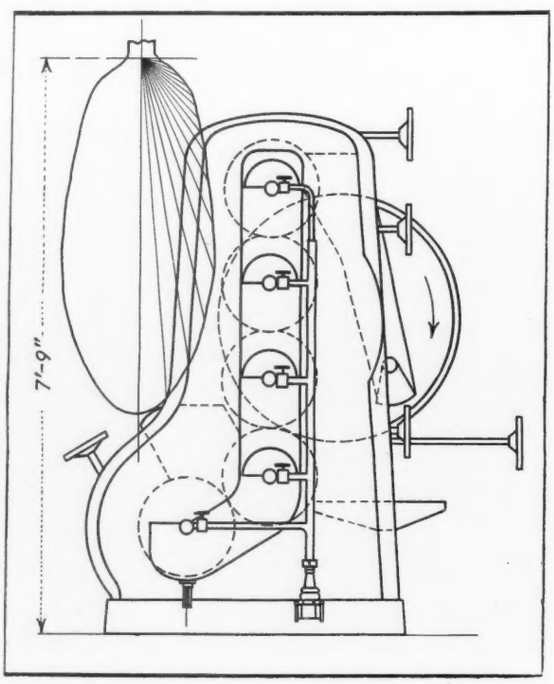

Figure 1. Distribution curve shows how light must be directed for proper illumination of a refiner

Kiss Wrapping

This operation is performed on individual machines which are arranged on both sides of a conveyor.

In operation, a batch of candy is placed at the left of the machine and there worked into a mass of such size that it can be fed into a set of rollers. These rollers in turn feed it into a second set which form the kiss to the proper size. From here it goes to a receptacle on the edge of a rotating disk which automatically wraps the confection.

General lighting of the order of 10 foot-candles, with 30 foot-candles at the critical seeing spots, is recommended for this operation.

Gum Drops and Jellied Forms

Molds made from plaster of paris and coated inside with corn starch are used. These molds are arranged symmetrically in shallow wooden trays which are moved by a belt conveyor to the injectors where the proper quantity of syrup is placed in each mold. When the confection has cooled and becomes hard, the corn starch is removed.

It is necessary that the injectors be kept clean and to insure cleanliness a good level of lighting, on the order of 20 foot-candles, is necessary. This lighting can be provided by a fairly concentrated source suspended above the equipment and directed toward the molds. Since the surface of the molds is white, the light is reflected to the injectors in an efficient manner.

Hard Candy

To make hard candy, sugar is cooked in vats to which are attached vacuum pumps that remove the moisture driven off from it. After the cooking process flavoring is added and the mass is removed from the vat, placed on water-cooled tables, and kneaded into an oblong shape.

After kneading the batch is worked into a long cylinder about 10 in. in diameter and 6 ft. long. It is then heated on one side, after which one end of the batch is worked to a tapering point which is inserted in a die-casting machine, Figure 2, which automatically shapes and cuts the candy. The candies are then chilled and removed to the bin table where they are mixed, after which they are temporarily stored until ready for packing.

At least 15 foot-candles of illumination is required for ingredient mixing and cooking, and 30 at the forming

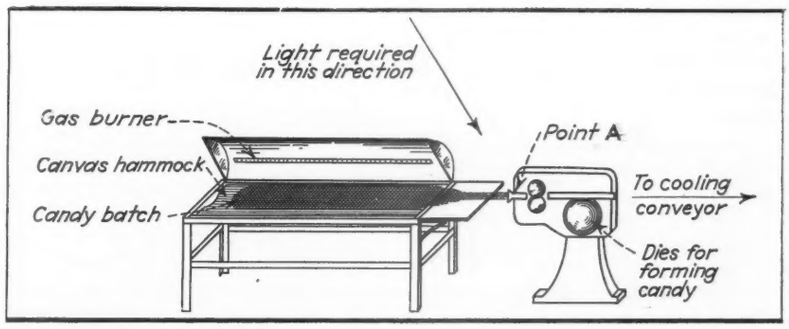

Figure 2. At point *A* on a hard candy forming machine an intensity of 30 foot-candles is required

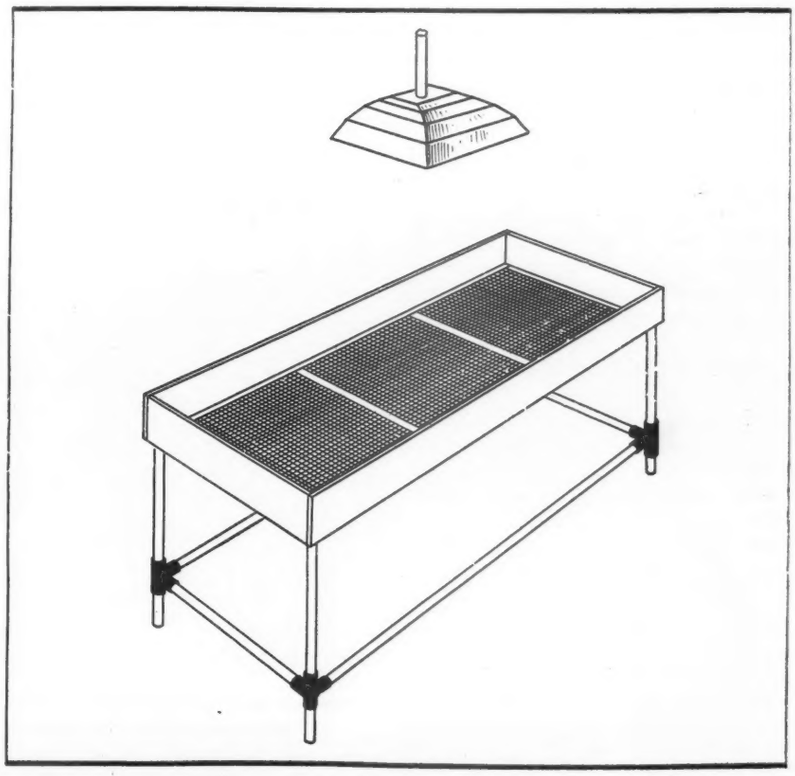

Figure 3. Well-diffused light with an intensity of 40 foot-candles is needed for mixing tables

Figure 4. Arrangement used in the stationary system of candy packing. An intensity of 20 foot-candles is recommended

machine. This level can be obtained by supplementary lighting with the units located between the operator and the die-cutting machine to avoid glare.

Hard candy is mixed by hand because the surface becomes scratched when handled by machine. Because hard candy has a glazed surface, the light provided at the mixing table should be well diffused. At least 40 foot-candles are recommended. Figure 3 shows a suggested way to light a mixing table, using a unit of low brightness and relatively large luminous area.

Assorted Packing

Candy packing may be done by any of three methods: (1) progressive system; (2) stationary system; (3) circular method. Figure 4 shows arrangement for stationary packing.

Visibility meter readings indicate that a level of not less than 20 foot-candles should be provided over the entire packing area, regardless of the method employed.

Special Holiday Mold Candy

Because a large amount of hand artistry is usually required in producing candies for special holidays, their manufacture is usually carried on where good quality daylight is obtainable. This is commonly found on the north side of the building.

Special molds made of brass, with an interior chrome finish, are employed.

A special machine consisting of a central horizontal shaft with six to ten spokes fastened securely to the hub is used in making the confections. The molds, in containers, are secured to the outer ends of the spokes and the machine turns clockwise with a jerky motion, which settles the liquid chocolate firmly in the mold crevices. The molds are then removed and placed in the hardening room. When hardened, the molds are removed and the design work is done.

Decorating or design work is done with small artists' brushes. The seeing task is, of course, severe and visibility meter readings indicate that at least 50 foot-candles are required. This level can be obtained from general lighting, plus supplementary lighting at the point of operation.

Box Making and Scoring

In the greater percentage of the factories surveyed, containers and boxes are made on the premises.

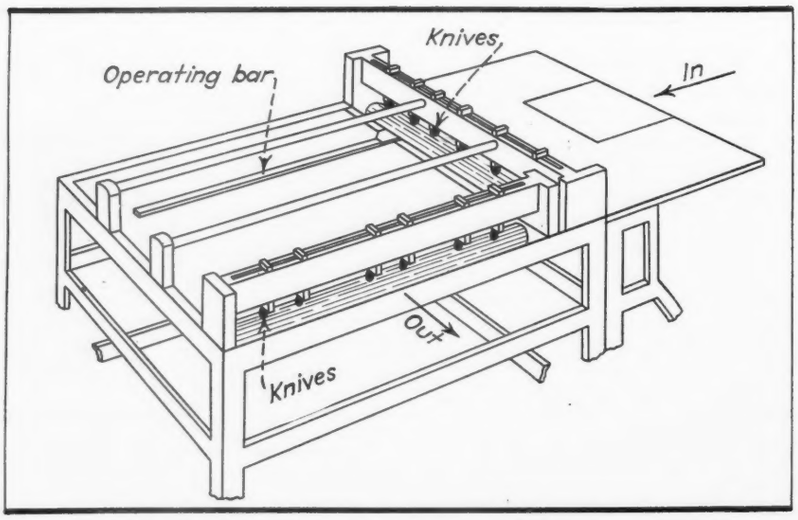

Figure 5. Majority of candy-making establishments covered in survey make their own boxes. Illuminating Engineering Society recommends 10 foot-candles of light for box-scoring operations

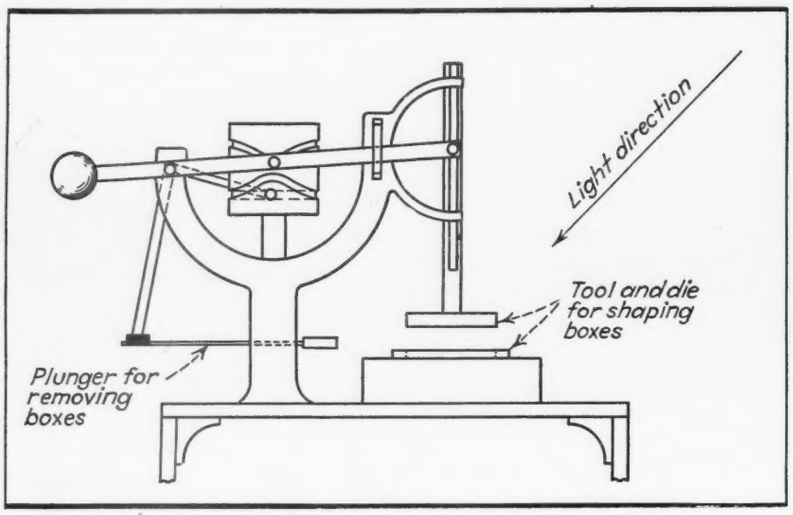

Figure 6. Recommendations call for supplementary lighting of 20 foot-candles at the box-forming machine—in conjunction with a general system providing at least 10 foot-candles for the area

The first operation in box making is scoring. It is done by machine and requires light of a predominantly horizontal character. In lighting this operation extreme care must be taken to see that the knife frame casts no shadow on the cardboard surface. This requires that the light source be located between the operator and the frame of the scorer.

The flat cardboard is usually fed over rollers located at the front of the machine, and the scorings are made by circular knives. Scorings must also be made at right angles to the original ones; therefore scoring machines have feeding rollers set at right angles to each other. Figure 5 shows one of these machines.

A system of general illumination providing at least 10 foot-candles at the knives is recommended.

When the cardboard has been scored it goes to the box-forming machine, Figure 6, where it is bent, automatically shaped, and gummed at the corners.

Because the containers are usually of a light color, there is a slight specular reflection from them and the direction of light becomes an important factor.

Supplementary lighting of the order of 20 foot-candles should be used in conjunction with a general system providing not less than 10 foot-candles for this area. The supplementary lighting units should be placed to direct light on the tool and die.

Where special art work is being done on the containers, at least 20 foot-candles of general illumination are required.

"Yours is a risky venture... storage batteries have no future"

SCOFFED AT IN 1888, EXIDE TODAY CELEBRATES FIFTY YEARS OF ACHIEVEMENT

FIFTY YEARS AGO, when The Electric Storage Battery Co. was formed, many business men were skeptical. Storage batteries, they said, were merely a laboratory experiment.

But critics were promptly silenced by the undeniable fact that the electrical industry was eager for these batteries. Street-car lines were among the first large users, installing battery-operated cars on many routes.

Today, Exides are used by railroads, steamship companies, and aircraft. They not only start our cars, trucks and buses, but their power is used to haul coal and ore underground, and to handle materials in industrial plants the country over. Exides operate emergency lighting systems in hospitals, schools, theatres, stores, and other buildings. Telephone companies, utility companies, radio stations and motion picture studios depend on these batteries for vital services.

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and the editors will gladly tell you more about the things mentioned on this page

• MEN with engineering libraries in the making will find useful a "minimum" list of books representative of engineering and its sciences. (7801)

• COATING, corrosion-resistant, protects exterior or interior surfaces subjected to corrosive liquids, gases, or solids. Quick drying, applied by brush or spray equipment. (7802)

• BEEN GIVING THOUGHT to industrial location? Bibliography will direct you to published material discussing important factors. (7803)

• EXHAUST SYSTEMS are more considered as industry improves its dust and fume control. Newly issued is a code and handbook of good-practice recommendations. (7804)

• CABLE CONNECTOR in each of its sizes accommodates several different cable sizes. Available in range from No. 8 solid wire to 2,000,000 circ.mil cable. (7805)

• MACHINE TOOLS—what they are, what they do for us, what kind of men operate them—get their story told in a booklet illustrated with closeups of the various types in operation. (7806)

• UNFAIR TRADE PRACTICES will be target of a business and professional men's committee. Draft of their plan for voluntary policing of these plans by business organizations can be had. (7807)

SOMETHING in your eye, miss? That pocket-size combination magnifier and mirror should help you see for yourself. The 3-power magnifier shows up small particles hard to see when looking into just a plain mirror. (7825)

IF YOU'RE THE KIND who becomes so engrossed in work that you miss the 11 o'clock appointment and forget to go to lunch, you need this clock. It can be preset to "remind" you, by buzzer and red light, at any 5-min. interval over a 12-hr. period. (7824)

• "HIS BROW is wet with honest sweat"—the sweat may still be honest but the brow needn't be wet. Sweat band of cellulose sponge pad absorbs 20 times its weight in moisture, can be washed, sterilized. (7808)

• "COLLECTIVE BARGAINING Under the Wagner Act" is a symposium touching all ramifications of this controversial law. Employee representation, machinery for adjustment of disputes, effect of the Act in industrial relations are among the subjects. (7809)

• SO FAST is the labor movement progressing that even its leaders have difficulty keeping up with the new policies developing every day. Prepared especially for them, but of interest to management, is a list of selected books and sources of information. (7810)

• STOP LEAKS against water pressure with a material that, mixed with concrete, accelerates the set. (7811)

• TRENDS in workmen's compensation legislation and practices are indicated in the published discussions of the convention of industrial accident boards and commissions. (7812)

• ALUMINUM PASTE plus water equals aluminum paint. Applicable on hot or cold surfaces, it becomes water insoluble when dry. (7813)

• SILICOSIS SURVEY was made of New York State foundry workers because they represent the largest trade exposed to the hazard in a single state. The report will probably be in great demand. (7814)

• SARDINES get out of captivity thanks to the key attached to the can. Now comes a vestpocket steel strapping cutter for opening cartons secured that way. It's shipped along with the package. (7815)

• WHAT MANNER of man is the steel worker, what is his education, how old is he, how is he paid, how does he play? Booklet gives the facts in graphic form. (7816)

• FIRST AID KIT, opened with a flip of the finger and easy to refill, has aluminum, weather-proof case resistant to corrosive atmospheres. (7817)

• RUBBER MATTING, patterned with stripes and corrugations, gives a floor covering one may well be proud of. It has style and strength, is tough, won't curl, comes in 3 colors, 4 widths, 3 thicknesses. (7818)

• COURT DECISIONS have gone against the National Labor Relations Board in very few cases a study shows. Effectiveness of the Wagner Act in preventing strikes, aims of C.I.O., labor in politics, incorporation of unions, it discusses too. (7819)

• SOLDER of unusually high tensile strength has lower melting point than most solder. Made by a special process, it is said to be free from adulterants, to contain only pure tin and lead. (7820)

• BLUEPRINTS and drawings can be fortified against wear by application of a 0.001-in. thick plastic foil which does not detract from legibility of figures or paper's flexibility. (7821)

• OFF COME hectograph ink stains with a cleansing cream designed especially for that purpose. Applied to the hands, it absorbs all kinds of copy-ink stains without harming even sensitive skins. (7822)

• READERS for whom *Factory's* war article in the May issue carried special interest, will find timely a report "America's Economic Strength in Time of War." (7823)

Cut Materials-Handling Costs with INTERNATIONAL Industrial Tractors

"Indispensable," says the Belknapp Hardware Co., Louisville, Ky., about their International I-12 Industrial Tractor. This small, compact unit works in their shipping room and hauls between buildings. They report that it only uses four gallons of gasoline in eight hours.

Solve your materials-handling problems and put these operations on a low-cost basis with International Industrial Tractors. The small Model I-12 is an ideal unit for this work. It is only 99 inches long, slightly over 4 feet wide, and turns within a circle having a radius of 8½ feet. Its economy is readily apparent in the reports from owners—it works continuously on about a gallon of gasoline an hour; many, like the Belknapp Hardware Company, report greater fuel economy.

International Harvester quality construction is built into the Model I-12 throughout. It has many features that have proved so efficient on larger International Tractors and on International Trucks. Equipment built around this tractor by many manufacturers further increases its usefulness.

Find out how the Model I-12 and other International wheel and crawler-type tractors can help you cut costs. The nearby International industrial power dealer or Company-owned branch will give you complete information.

INTERNATIONAL HARVESTER COMPANY
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180 North Michigan Avenue **Chicago, Illinois**

INTERNATIONAL Industrial Power

What's New in Equipment

Time Switch

Type TSA-14 automatic time switch can be used for process timing, has all-glass cover for easy inspection. Contact-making mechanism is driven through a spur gear train by a Telechron motor. Dial is marked in per cent of total time. Percentage of "on" time may be varied merely by rotating the dial until the desired percentage of "on" time is indicated by the pointer. Silver contacts are rated at 10 amp., 230 volts. General Electric Co., Schenectady, N. Y.

Jib Crane

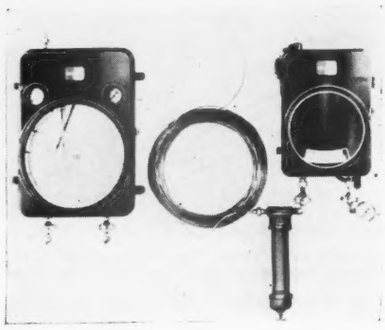
Self-supporting pillar jib-crane designed for use in low headroom areas and confined spaces. Capacities up to 5 tons, heights up to 20 ft., and maximum radius of 20 ft. May be furnished with either pendant rope or pushbutton control on the hoist. May also be equipped with pushbutton, master, variable-speed controller which controls all lifting, lowering, and traveling operations. Harnischfeger Corp., 4400 West National Ave., Milwaukee.

Respirator

Helmet-type respirator is adapted to overhead and outdoor paint spray work, and protects head, neck, and shoulders. Is light in weight and easy to wear. Muslin hood is attached to cap and fits snugly over shoulders. Window is large and easy to clean. Cap has air connection at back. By taking off a "Tee" at the air connection to the spray gun, and by using an air-adjusting valve, a small amount of air can be brought into the helmet by means of a small length of hose. Air thus brought into the mask pushes downward and out, keeping fumes from operator. Known as "686 Paint Spray Mask." Binks Mfg. Co., 3114-40 Carroll Ave., Chicago.

Telemetering System

"Metavane" pneumatic telemetering system may be used for recording and automatically controlling temperature, flow, pressure, and liquid level. Particularly well suited for use in plants where explosive fumes are present, because it is operated entirely by air under pressure. Consists of two instruments: the transmitter and the receiver. Transmitter measures variable, indicates value on scale for use of operator, transmits reading to the receiver, which may be several hundred feet away. Two instruments are connected together by means of copper tubing. A 15-lb. air supply provides power. The Bristol Co., Waterbury, Conn.



Bolt Head

"Safety Hook Bolt Head" is placed on an ordinary bolt for use where a forged hook bolt would normally be required. Can be used where girders, beams, and angles are being set up in structural work. Has notched section on one side to grip I-beam or other structural member. Has recessed section into which bolt head fits. Also available is deep washer used to fill the head recess when head is placed on threaded end of the bolt. This allows nut to be tightened. The Fanner Mfg. Co., Cleveland.

Fire Nozzle

Phomaire Play Pipe Model PP24 makes 500 to 750 gal. of fire-smothering foam per minute and produces 350 gal. of foam from 1 gal. of Phomaide solution. When nozzle is connected to a hose line and the water is turned on, Phomaide and air are drawn into the water stream to form the foam. Water at 75 lb. pressure or more may be pumped from suction, hydrant, or water tank. Only 35 to 40 gal. are required per minute. Pyrene Mfg. Co., 560 Belmont Ave., Newark, N. J.

Time Clock

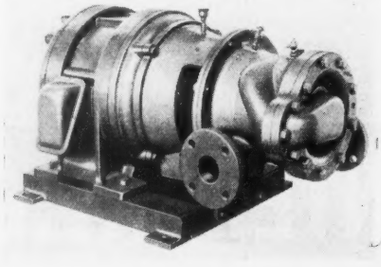
Automatic electric time recorder operates by insertion of the time card. A self-contained program device, adjustable to the minute, not only automatically shifts registration from day to day and between a.m. and p.m., and in and out for each shift of employees, but can also be set to ring warning bells in advance as often as necessary. Equipped with automatic blue and red auditing device. Only limit to speed of recording is time required for employees to pass before the machine. International Business Machines Corp., 120 Broadway, New York.

Salt Tablet Dispenser

Two models. Model B-3 has visible tablet supply and capacity of 1,500 tablets. Model B-6 has a capacity of 350 tablets. Both are molded of plastic, are moisture-proof, and are provided with lock top and key. Both have metal wall bracket mountings and are provided with labels giving instructions as to use. Industrial Products Co., 2795 North 8th St., Philadelphia.

Centrifugal Pump

Two-stage "SSUnit" pump is good for heads up to 525 ft. at 3,550 revolutions. Has capacity range of 50 to 100 g.p.m. against heads of 300-500 ft. Is bolted to motor frame by a splash-proof connection piece, the impellers being



Di-Mol stands it!

Disston Di-Mol Blades need no coddling in the hands of shop men. Di-Mol withstands trying feeds and speeds in modern machine sawing, too.

Compare the economy in blades, and production per blade . . . especially with carbon steel or ordinary molybdenum. Disston Di-Mol Blades cut faster, cut longer, cut with less cost. "Disston Di-Mol" (on orange band on blade) means Disston workmanship: assured quality and uniformity—Blades made with the precision of machines! Standard teeth, lengths, widths, thicknesses. Hand blades, ½ gross in box. Machine blades, 1 dozen.

Test them on your own work and prove to yourself they can take it! Henry Disston & Sons, Inc., Philadelphia, U.S.A.

Branches: Boston, Chicago, Detroit, Memphis, New Orleans, Seattle, Portland, Oregon, San Francisco.

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FOR DEMONSTRATION WRITE YOUR DISTRIBUTOR OF DISSTON DI-MOL HACK SAW BLADES

ESTABLISHED 1840
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DISSTON DI-MOL
HACK SAW BLADES

mounted on the special motor shaft extension. Available with motors of from 10 to 30 hp. of standard squirrel-cage type, splash-proof or explosion-proof. Suggested uses are boiler feed, air conditioning, humidifying, small pipe lines. Cast iron casing, bronze fittings. Allis-Chalmers Mfg. Co., Milwaukee.

Lift Truck

Model 2000 is a single-stroke, side-lift, hand-lift truck. Standard equipment includes semi-steel wheels. Lifting parts are forged steel. Is said to be light in weight with a capacity of 2,000 lb. The Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia.

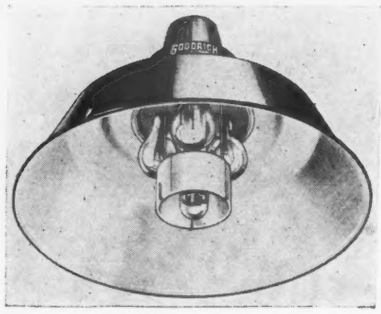
Air Cleaner

"Linconditioner" filters out dirt particles from air in the vicinity of grinding, welding, and other operations. Also draws smoke and heat away from work. No air is taken in or blown to the outside of the building; the plant heat is

conserved. Consists of motor-driven fan that produces suction through a flexible metal tube. Fan draws air through the tube and exhausts it in a filter located in the power unit. Flexible tube is supported by welded steel arm and spring arrangement so that nozzle can be shifted to any spot within the operating radius of the tubing. Fan is powered by ½-hp., 2- or 3-phase, 60-cycle motor. Flexible tubing is 10 ft. long and permits operation within a circle 14 ft. in diameter. The Lincoln Electric Co., Cleveland.

Lubrication Control

BB fitting is a lubrication safeguard that makes it almost impossible to overload anti-friction bearings through high-pressure lubricant application. The device is used in connection with present grease cup or high-pressure fitting, at the bearing. With this fitting, lubricant is introduced to the bearing through a central duct. When pressure at the bearing reaches 2½ oz., or the designed maximum, back pressure forces lubricant past a calibrated orifice in the base of the fitting and out through relief ports at the side. As soon as excess grease appears at these relief ports it is a signal that the bearing is sufficiently lubricated. Keystone Lubricaitng Co., Philadelphia.



Lighting Unit

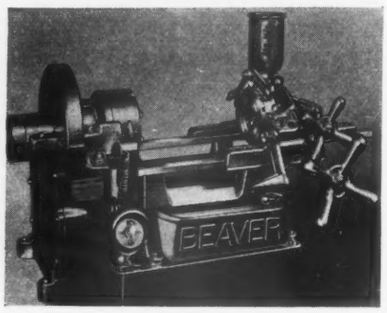
"Combination Dome" is a mercury-incandescent lighting fixture. Mercury lamp is surrounded by incandescent lamps, and a diffusing glass cylinder prevents glare. The 24-in. porcelain-enameled reflector has white inside reflecting surface and green exterior finish. Goodrich Electric Co., 2900 North Oakley Ave., Chicago.

Conductor Strain Clamp

"Hi-Lite" strain clamp for dead-ending small conductors has a loop under its nose making it possible to attach the blocks for securing proper conductor tension directly in the clamp. When tail block is hooked in the loop the conductor is brought to tension, the entire dead-end assembly assumes a position that is practically a continuation of the conductor. Clamp accommodates 0.35- to 0.55-in. conductors when unlined and 0.30- to 0.45-in. conductors when furnished with liners. Ohio Brass Co., Mansfield, Ohio.

Pipe Machine

Model B pipe machine cuts, threads, and reams nine sizes of pipe from ⅛ to 2 in. in diameter, cuts bolts from ⅜ to 1 in., threads bolts up to 2 in. Can be arranged with driveshaft and geared tools to cut and thread 2½- to 12-in. pipe. Uses gravity oil feed. May be



bought in units, starting with the power drive which can be used to operate all makes of hand threaders and cutters. Beaver Pipe Tools, Inc., Warren, Ohio.

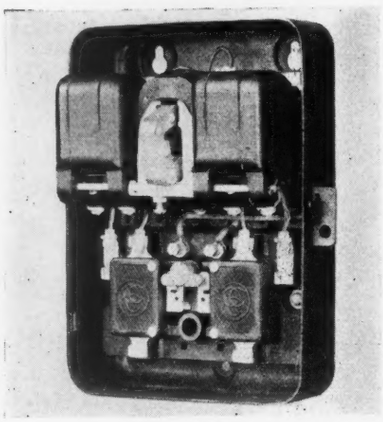
Photoelectric Counter

Photoelectric counter uses standard mill-type lamp as a light source. The unit is self-contained, has light louver system to keep out all extraneous light and a condensing lens to direct full light energy on the photoelectric cell. Parts moving along a conveyor, separated by only ¾ in., can be counted. A.c. or d.c. 110-volt supply is used. Wayne Automatic Relay Co., Fort Wayne, Ind.

Relay

RS100 relay can handle single-phase motor loads up to 1 hp. or heating loads up to 1.5 kw. Is 2-wire, normally open, and has large double-break contacts. Has extra terminal for supplying power to wall clocks, indicating lamps, or small sensitive relays, eliminating the necessity for a separate low-voltage source. General Controls Co., 450 East Ohio St., Chicago.

Starters



Bulletin 6013 automatic starters are for starting squirrel-cage induction a.c. motors by connecting them across the line. They may also be used as primary switches for wound-rotor induction motors. Non-reversing, they have overload protection. Available in several sizes and in different forms. The Clark Controller Co., 1146 East 152d St., Cleveland.

Floor Mat

"Saf-T Mat" has a resilient, non-slip surface assuring protection against accidents from slipping and provides a restful footing for workers who must stand in one position on hard, wet, or cold floors. Grating is formed by laminated rubber strips and heavy cords of long fiber impregnated with rubber. These are clamped between cadmium steel plates bound together with galvanized or stainless steel rods. Mats are ⅝ in. thick and can be made to almost any size or shape. Saf-T Mat Co., 4451 North Mason Ave., Chicago.

Belt Idler

Self-aligning idler for automatically training conveyor belts consists of an anti-friction idler pivotally mounted on a supporting cross member, with guide rolls at each end. The guide roll moves outwardly the instant the belt touches it, and in so doing swivels the idler sufficiently to cause the belt to return to normal position. Guide roll arms are held in place by an easily removed lock

Non-Stop **FLOW FROM SEALERS TO STOCK**

LAMSON CONVEYORS Cut Handling Costs for Johnson's Wax

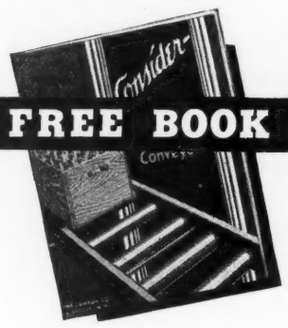
Upper Right—Switching station in the modern plant of S. C. Johnson & Son, Inc., Racine, Wis., where five production-line conveyors meet and deliver their loads to a trunk-line conveyor. Cartons accumulate on the production conveyors until a trunk-line switch is thrown, when they move along in trains of 12 or more to the freight cars or stock rooms.

Above—Showing the production line conveyors which converge at the switching station shown in top plate. Each conveyor leads from a production unit.

Providing "through traffic" of finished materials—with filled cartons moving in unbroken lines from the sealers to freight cars or stockrooms—Lamson Conveyors have eliminated wasteful re-handling, and thereby *cut costs*, for the makers of famous Johnson's Wax.

Five lines of gravity and belt conveyors deliver the cartons from the production machines to a central terminal. Here they are switched to a trunk-line conveyor which carries them directly inside waiting freight cars, or to either of two stockrooms as desired.

In designing this through-traffic system, Lamson engineers used parts of a conveying system existing in the plant. This plan is followed wherever possible adding only sufficiently new equipment to improve production flow. It gives modern conveying efficiency at minimum cost. Any of our factory-trained engineers—located in key cities throughout the United States and Canada—will be glad to consult with you about modernizing your conveying system. Mail the coupon for additional facts—or ask for an engineer to call.



FREE BOOK Shows New Ways of Cutting Production Costs

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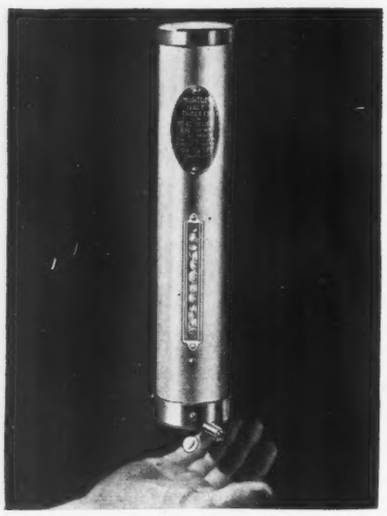
pin. Merely by swinging the arms through 180 deg. and putting the lock pin in place on the opposite side, the guides are made ready to train the belt when traveling in the reverse direction. The Jeffrey Mfg. Co., Columbus, Ohio.

Register

"Protect-O-Form" automatic register has "locked-in-copy" feature. This provides a continuous audit record by automatically filing a secret copy in a locked compartment. This protects against loss or alteration, and assures accurate accounting of all hand-written records. Move orders, count tickets, shipping reports, packing slips, and work orders are only a few of the many applications for this. It weighs 3½ lb., holds up to 125 sets of triplicate continuous forms. The Standard Register Company, Dayton, Ohio.

Salt Tablet Dispenser

All-metal cylinder, fitted with wall bracket for mounting at drinking fountains, dispenses 10- or 15-grain salt tablet when small lever at its base is operated. Corrosive-free metal prevents chemical reaction between salt and metal. Instructions for use of salt tablets are engraved on a polished metal plate on the dispenser's face. Tablets are kept dry and clean at all times. Morton Salt Co., Morton Bldg., Chicago.



Glue Pot

Automatic water-jacketed glue pot has thermostatic control of the heat to a maximum of 150 deg. F., with prevention of localized overheating of the glue. Pots come up from cold to heat in 45 min. Easily replaced heating elements. Come in ½ pt., 1 pt., and 1 qt. Supplied for 110-120 volts, or 220-230 volts. Vulcan Electric Co., Lynn, Mass.

Steel

"Ledloy" steel is steel in which lead has been alloyed and in which the lead is uniformly dispersed throughout the steel. It is claimed that the lead is in such a fine state of dispersion that it has no effect upon the physical properties of the steel, but greatly increases the rate at which it can be machined. Lead is introduced in amounts from 0.15 to 0.30 per cent. Physical properties are the same as other steels of like analysis produced without addition of lead. Tool life is increased, but heat-treating procedure and weldability remain unchanged. Inland Steel Co., 38 South Dearborn St., Chicago.

Lighting Fixture

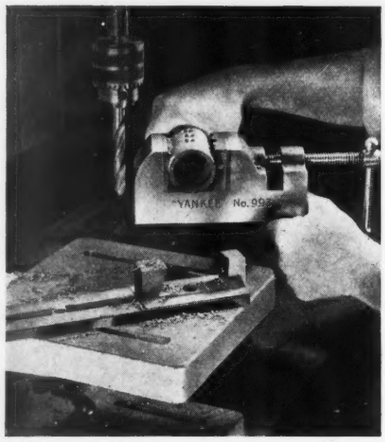
"Correctalite" is a semi-direct lighting fixture that finds application in offices, drafting rooms, and the like. Has prismatic light director that controls reflected and direct light rays. Light controlling element consists of the prismatic reflector and a bottom bowl-shaped refracting member in which there is a removable plate to permit easy relamping. Fixtures are made of brass. Holophane Co., Inc., 342 Madison Ave., New York.

Woodworking Machine

"Ever-Ready Combination Woodworker" is said to be capable of forty different woodworking operations, being a combination of saw table, jointer, bandsaw, lathe, shaper, mortiser, and sander. One motor running from a light circuit operates all units. All attachments are always in alignment and all working parts are guarded. Occupies 5x6 ft. of floor space. Belt drive is direct, there being no countershafts nor idler pulleys. Saw table raises and lowers and can be placed at a 45-deg. angle for bevels and compound miters. It is also said that it can be changed from one operation to another in less than half a minute. Hutchinson Mfg. Co., Bridgeport, Pa.

Vise

"Yankee" vise is made in four sizes: 1½-, 2-, 2¾-, and 4-in. jaw widths, with or without swivel base. When used on bench with swivel base it can be detached quickly, holding work in original alignment. May be used either on side or ends as well as on base. Jaws are faced with hardened steel plates. Swivel base can be locked in any position. Also available is "Yankee" vise clamp which



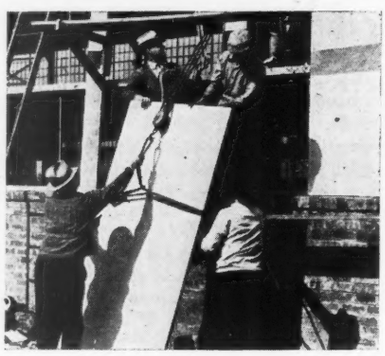
increases the utility of the vise. This clamp rigidly holds the vise with the work for drilling and other machining. North Bros. Mfg. Co., Philadelphia.

Time Meter

"Running Time Meter" automatically registers operating time of circuit, apparatus, or system to which it is connected. Made in two types: one for registering total hours, and one for registering total minutes. Five-dial counter registers in tenths. Driven by slow-speed, self-starting synchronous motor. Meter connected in parallel with machine operated, and the motor starts and runs continuously while the machine is operating. R. W. Cramer & Company, Inc., 67-69 Irving Place, New York.

Wall

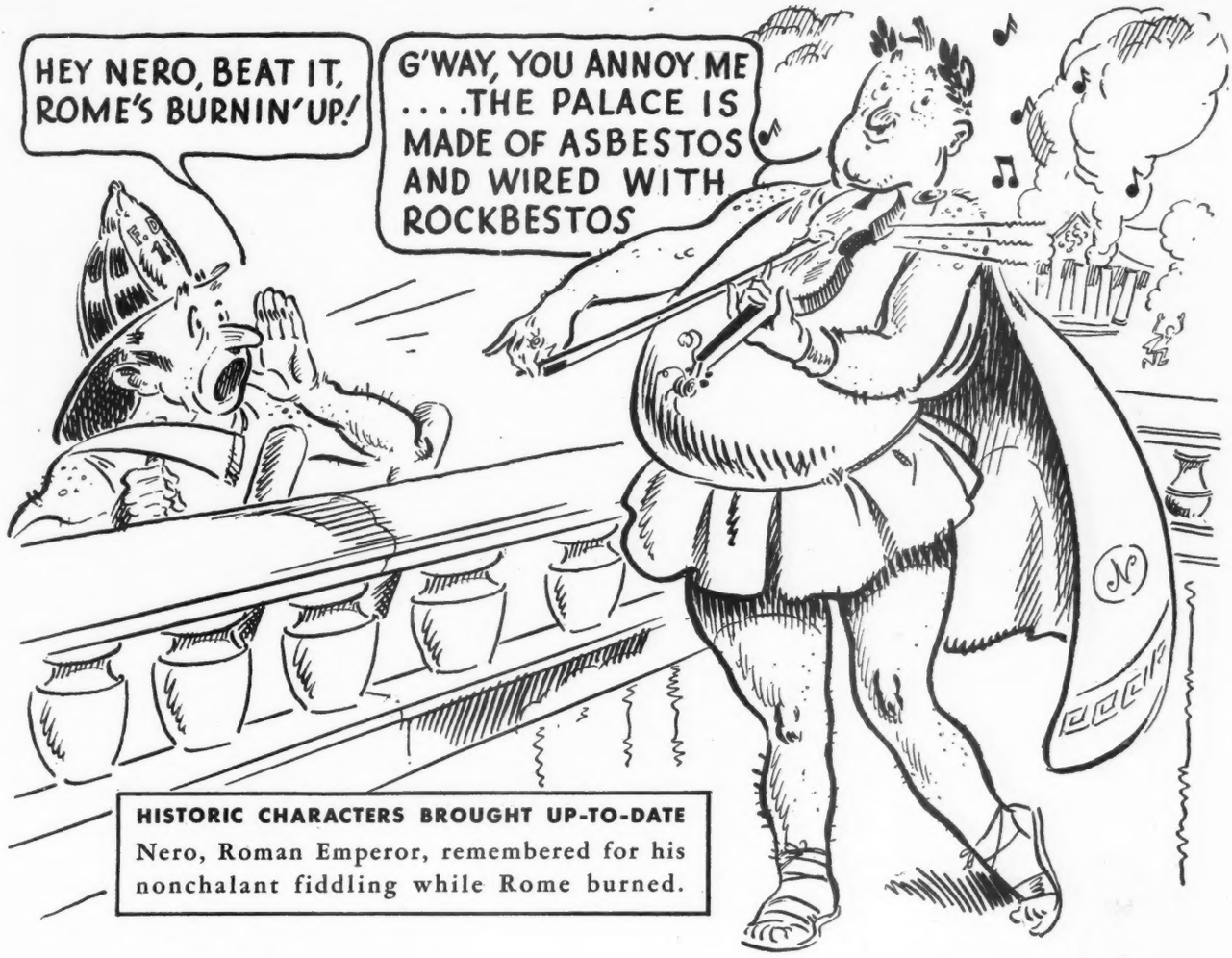
"Industrial Curtain Wall" is an insulated curtain wall for steel frame factory buildings. Consists of 1 in. of insulating board with a ⅛-in. veneer of asbestos Flexboard or Flat Transite, over which is applied a wall of corrugated Transite. The components are



bonded at the factory and are shipped in units ready to be erected on arrival at job. Said to have high fire protection value, and almost complete salvage in case unit must be relocated. Light gray in color, and no painting is required. Johns-Manville, 22 East 40th St., New York.

Lamp Transformer

"TuLamp" transformer designed to operate two 400-watt mercury lamps. Unit is 1½ in. wider and somewhat



HISTORIC CHARACTERS BROUGHT UP-TO-DATE
Nero, Roman Emperor, remembered for his nonchalant fiddling while Rome burned.

We always wondered about the calm indifference displayed by Nero when he sawed out Roman rhythm and smoky sonatas, whilst flames swept on apace during the big barbecue. Such unconcern wouldn't be so hard to figure if a repeat performance were staged today. Now, public buildings are fireproof, and many of them are . . . *wired with* Rockbestos!

Fire doesn't mean a thing to Rockbestos because its insulation is made of *asbestos.* It is . . . *positively flameproof* . . . because it will not support combustion . . . *absolutely heatproof* . . . because it will not dry out and deteriorate under high temperatures . . . and *inherently indestructible* . . . because it will not rot, bloom, or swell from contact with corrosive fumes, grease or oil. Use Rockbestos for permanent installations and checkmate fire hazard. Use it in wire-wrecking circuits to eliminate breakdowns and reduce maintenance expense.

Think these money-saving angles over and call on us. Probably we can help you. We have representatives in all the large manufacturing districts who will be glad to tell you about our line of heat-resisting wires, cables and cords. If you want samples or a catalog write to headquarters, Rockbestos Products Corporation, 890 Nicoll Street, New Haven, Conn.

Also refer to Electrical World Buyer's Reference Number of 1938.

heavier than the company's single-lamp transformer but is practically the same in general design. Starting currents are below normal operating current so that no provision need be made in wiring to take care of excess starting values. Should one lamp burn out, the other lamp will operate normally without injury to the transformer. General Electric Vapor Lamp Co., Hoboken, N. J.

Synchronous Motor

Direct-connected synchronous motor for reciprocating compressors requiring down to 40 hp. features exciter mounted on top of the motor, V-belt-driven from a sheave on the rotor of the motor, and automatic, inclosed, wall-mounted control. Control requires little space and is simple to install. The line control unit is magnetic, full-voltage type with overload and under-voltage protection. Field control unit is slip-frequency responsive type for automatically applying and removing motor field excitation. Electric Machinery Mfg. Co., Minneapolis.

Desk Lamp

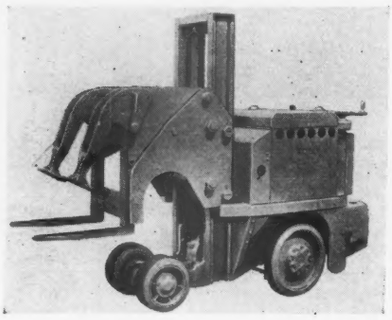
Model ZAT portable desk lamp is addition to the company's Canopy line. Stands 21 in. high with edge of reflector 17½ in. above work surface. Light pattern is rectangular to conform to desk or table area. Reflector measures 20 by 14 in. Trough accommodates up to two 100-watt, inside-frosted lamp bulbs. Lighting is indirect. The Fostoria Pressed Steel Corp., Fostoria, Ohio.

Spray Cleaners

Models J and K Hypressure Jenny are steam-vapor spray cleaners for removing grease, dirt, and oil from motors, machinery, floors, walls, building exteriors, etc. Model J is a portable, fully automatic unit with electric ignition and nozzle control. Has pressure atomizing fuel oil burner, with all mechanism mounted on end panel fully inclosed. Operates at pressures up to 150 lb. Model K is a stationary, continuous-vapor-flow unit, manually ignited kerosene burner, and operates at pressures up to 110 lb. Homestead Valve Mfg. Co., Inc., Coraopolis, Pa.

Trucks

Type F-10 truck has rated capacity of 5,000 lb., two-wheel drive and four-wheel steer. Drive axle is equipped with 500 per cent overload, series-wound, four-pole, heavy-duty, and high-torque motor. Motor is direct-connected to free-coasting worm and gear. Four speeds forward and four reverse. Power circuit is closed and broken by a mill-type,



magnetic blow-out contactor. It has tin plate clamps that automatically lower and hold the plate when the forks are raised. Solenoid brake on hoist motor is supplemented by regenerative braking. The Elwell-Parker Electric Co., Cleveland.

Generator Set

Diesel generator set is offered in two sizes, a 4-cylinder engine delivering 45-55 kw. and a 6-cylinder engine delivering 65-85 kw. Either a.c. or d.c. is available, and units can be supplied complete with generator built into the flywheel housing, or separate and driven through a flexible coupling. Diesel engine employs solid injection. Starting is on gasoline, and a simple handwheel control permits switching over to diesel fuel. Murphy Diesel Co., Ltd., Milwaukee.

Timer

"Polyflex" is a synchronous motor-driven, time-delay relay for applications not requiring frequent adjustments of timing intervals. Particularly suited for applications where timing interval between functioning of two or more contacts is required. May be adjusted in the field to provide timing sequences with its clutch coil either energized or deenergized during the timing interval. Can be used for delayed starting of motors in a prearranged sequence upon restoration of power following power failures. Also finds application in elevator controls and solenoid valves. Eagle Signal Corp., Moline, Ill.

Electric Drills

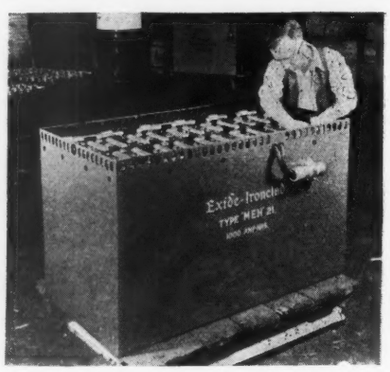
Three special-duty drills. Model 101 has ⅝-in. capacity in steel, no load speed of 300 r.p.m.; is 18¼ in. long, weighs 16¼ lb. Model 121 has ¾-in. capacity in steel, no load speed of 250 r.p.m.; is 18¾ in. long, weighs 18¾ lb. Model 141 has ⅞-in. capacity in steel, no load speed of 200 r.p.m., and is powered for tough drilling jobs on metals and wood; is 19½ in. long, weighs 17 lb. Skilsaw, Inc., Dept. B., 3316 Elston Ave., Chicago.

Tubing for Solvents

"Resistoflex" PVA tubing is made of a flexible synthetic resin inert to gasoline, oils, and organic solvents. It retains its flexibility throughout a wide temperature range; comes up to and including ½ in. inside diameter. Material is said to be tough, pressure-resistant, elastic, and so flexible that the tubing may be tied in knots. Resistoflex Corp., 370 Lexington Ave., New York.

Truck Battery

Type MEH electric industrial truck battery can operate trucks of 30,000 lb. or more capacity for 12 or more hours on one charge. Has 18 cells, 21 plates, assembled in steel trays, and weighs 4,200 lb. Dimensions are 54⅛ x 25⅞ x 31⅛ in. Capacity is 1,000 amp.-hr. or 34.4 kw.-hr. A 24-cell size, with 21 plates per cell, has a capacity of 45.9 kw.-hr. The Electric Storage Battery Co., Allegheny Ave. and 19th St., Philadelphia.



Pump

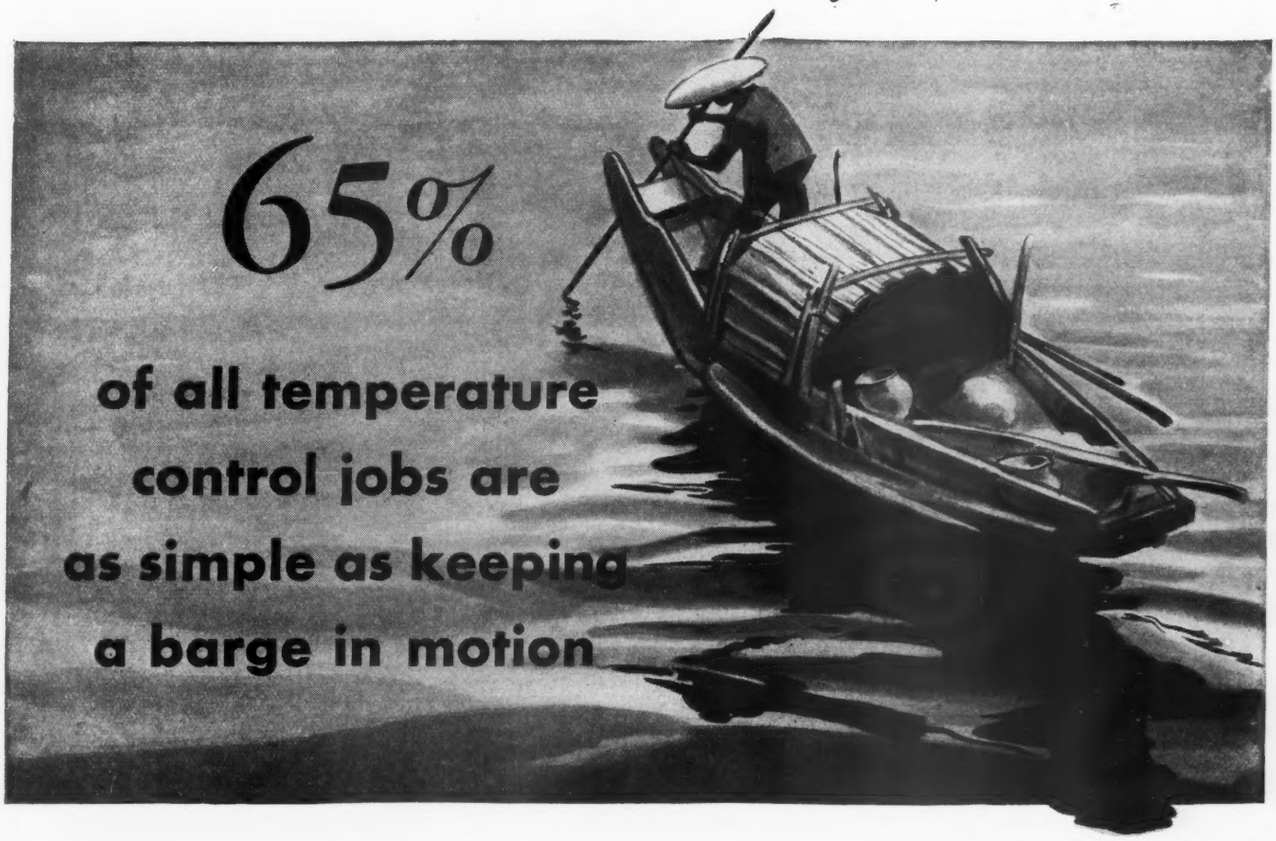
"Bee" portable self-priming centrifugal pump is powered either by gasoline engine or an electric motor, and can be carried by hand to any job requiring quick removal of water. It weighs but 55 lb. The Barnes Mfg. Co., Mansfield, Ohio.

Torch

No 2 torch is designed especially for light brazing, electrical soldering, sheet metal soldering, and copper pipe fittings

OPEN AND SHUT CONTROL

saves money!



A barge or sampan is readily kept in motion at a uniform speed with an occasional push of a pole because it has relatively small friction and large inertia. For similar reasons most temperature control jobs are easy to control because they have relatively small *demand* and large heat *capacity* —and require only occasional opening and closing of the valve for *uniform temperature control.* For these jobs the simple "open and shut" controller is best!

65% of all temperature control problems have been solved by Foxboro for over a quarter of a century by the "Open and Shut" type of Controller. For these it is the best—regardless of price. And, in most cases no other form of control will work as well.

The 65% include kettles, kilns, ovens, cookers, pickling tanks, and the like. Millions of chart records attest to the fact that Foxboro "Open and Shut" Controllers give unbeatable control—whether the job be a small one or a big one; whether it be for boiling hams or annealing the 200-inch glass disc for the world's largest telescope.

Take full advantage of Foxboro's unequalled store of experience. Let a Foxboro representative survey your needs. Hundreds of manufacturers have saved money through the use of "Open and Shut" Control. The Foxboro Company, **24** Neponset Avenue, Foxboro, Mass., U. S. A. Branch Offices in 25 Principal Cities.

On the other 35%, Foxboro Stabilog Controllers must be used. The Stabilog Controller was perfected by Foxboro to meet specific problems involving varying amounts of throttling range for the 35% that cannot be controlled by "Open and Shut" Control. The Stabilog and the "Open and Shut" type of Controller are not interchangeable . . . and neither supplants the other. Each has its definite field of application. Whatever your need, Foxboro assures the most efficient and economical system of control. Let a Foxboro engineer assist you.

FOXBORO REG. U. S. PAT. OFF. *Certified* **TEMPERATURE CONTROLLERS**

up to ¾ in. in diameter. Produces a brush-type blast flame ranging from 3 in. long and ⅜ in. in diameter to 8 in. long and ⅝ in. in diameter. Produces temperatures up to 2,500 deg. F. Insto-Gas Corp., 1900 East Jefferson Ave., Detroit.

Telephone Booth

Two types of acoustic telephone booths for noisy locations where space is limited. Model 301 is bolted to a wall or pillar, Model 401 rests on bench or desk. Lining of perforated metal backed by a soft sound-absorbent removes extraneous noises. Model 301 has built-in

electric light and shelf. Both units are made of steel. Acoustic Division of Burgess Battery Co., 111 West Monroe St., Chicago.

Arc Welder

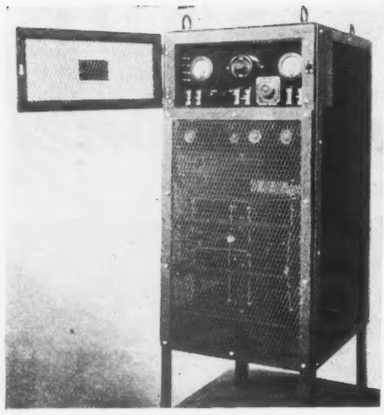
"Trans-Arc" is a transformer-type arc welder with a low open-circuit voltage for greater safety, and a relatively high voltage for maintaining the arc. Welding current is controlled by means of a continuously variable auto-transformer regulator that varies voltage across condensers. Arc is said to be steady in all positions when working on either light or heavy materials. Made in 150-, 300-, and 500-amp. sizes for operation on either 230 or 460 volts, 60 cycles. American Transformer Co., 178 Emmet St., Newark, N. J.

Communicating System

"DeLuxe" type 24-station intercommunicating Teletalk unit provides twelve simultaneous conversations without cross talk or interference. Three-way talk-listen switch allows cutting of power supply when unit is idle. Erasable nameplate can be written on with either pen or pencil. Webster Electric Co. Racine, Wis.

Battery Charger

"Rectomatic" self-regulating battery charger automatically varies charging rate proportionate with the demands on the battery. Designed and adjusted to maintain battery at voltage of 2.15 volts



per cell under any condition of load within its rating. Consists of Rectox rectifying unit, insulating transformer, regulating reactors, terminal board, meters and fuses, all mounted in a ventilated sheet steel structure. Sixty-cell chargers are arranged for floor mounting; chargers for 24 cells or less are arranged for wall mounting. Westinghouse Elec. & Mfg. Co., East Pittsburgh.

Safety Valve

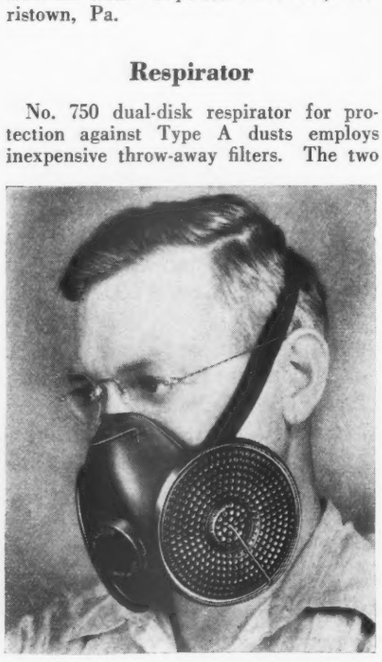
"Consolidated Safety Valve Type 1559" has been designed for pressures up to 2,500 lb. per sq.in., 1,000 deg. F. Valve follows general design that is now being used on high-pressure boilers. Consolidated Safety Valve Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Monel Tubing

"Brawn" Monel tubing is made by a patented method of pressure brazing and cold drawing that produces a homogeneous tube wall which approximates seamless in tensile, compression, and bursting strengths. Available in sizes from 1/16-in. outside diameter by 0.007-in. wall to ⅝-in. outside diameter by 0.049-in. wall. Superior Tube Co., Norristown, Pa.

Respirator

No. 750 dual-disk respirator for protection against Type A dusts employs inexpensive throw-away filters. The two



filters provide 28 sq. in. of filtering surface and offer very little resistance to breathing. Willson Products, Inc., 242 Thorn St., Reading, Pa.

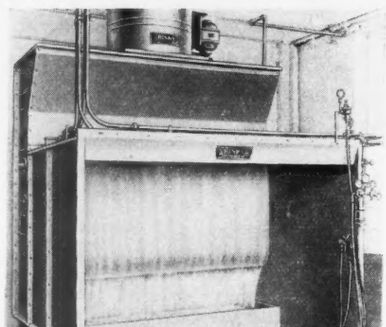
Variable-Speed Transmission

"Select-O-Speed" variable-speed transmission uses V-belts and is available in several sizes up to 7½ hp. Variation of speed ratio is made possible by an arrangement of two interlocking sheaves, which may be pivoted laterally by a slight movement of the control lever. May be mounted on the floor, wall, ceiling, upside down or right side up, and is said to work without noise or vibration in any position. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Gasket

"Flexiwound" gasket is a spirally wound metal-asbestos gasket that is said to combine mechanical strength, high resistance to corrosion and extreme temperatures, proper compressibility with relatively light bolting, and resilience. It is also said that because of this resiliency it can be used a number of times in standard or special flanges, for boiler tube caps, or handholes and manholes. Azor Corp., Newark, N. J.

Paint Reclaimer



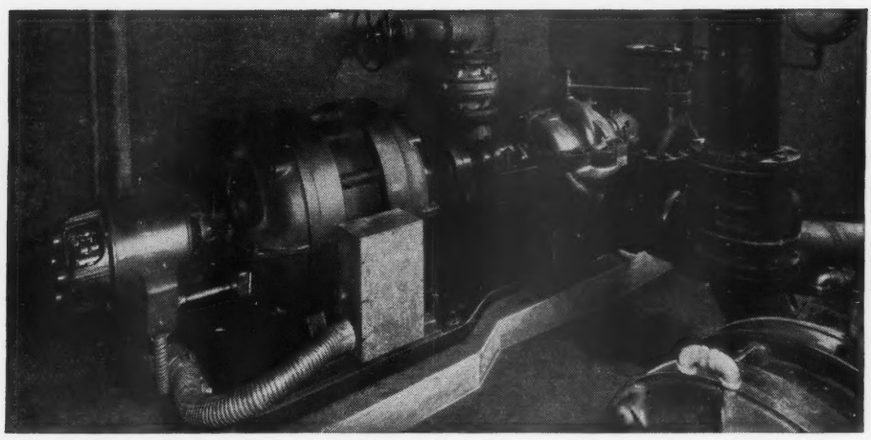
"Dynaprecipitor" cleans all types of paints, synthetic enamels, vitreous enamels, etc. Cleaned by a water curtain which extends the full width of the spray booth. Paint pigments striking this curtain are washed down into the collecting pan. Precipitator plates are self-cleaning. Binks Mfg. Co., 3114-40 Carroll Ave., Chicago.

Flow Indicator

"Bull's Eye Sight Flow Indicator" shows whether or not fluid is flowing through pipe line. Consists of simple pipe fitting having two round sight glasses located on opposite sides and held in position by bolted cover plates. Between glasses is a flapper suspended in such manner that it hangs against a seat when there is no flow. As soon as flow commences, flapper swings outward and upward. Fischer & Porter Co., 110 West Penn St., Germantown, Philadelphia.

SAVES 13% IN HORSEPOWER!

Mead Johnson & Co. Saves 13% in Horsepower by Replacing Out-Dated Pumps with an Improved, Modern Allis-Chalmers Pump. Find Out How Allis-Chalmers Pumps Can Cut Your Operating Costs . . . Can Pay for Themselves in the Dollars They Save!



THE PUMP THAT GAVE A SAVING OF 13% in Horsepower to Mead Johnson & Co. This 10″ x 8″ Type SH pump with synchronous motor drive, rated 2400 gpm, 105 ft. head, replaced two 6″ pumps in the Evansville, Indiana, plant.

A saving in horsepower of 13%! Old pumps replaced by a modern design pump with improved efficiency! That's how Allis-Chalmers cuts operating costs . . . slashes overhead . . . leads the way to bigger profits!

In the pump room of Mead Johnson & Co., manufacturers of infants' foods, at Evansville, Indiana, were two 6″ pumps—good pumps, but they were fifteen years old! They operated twenty-four hours a day, six days a week — but they were only 74% efficient! They still gave service — but a new pump could give the same amount of water for less money!

Mead Johnsor & Co. consulted Allis-Chalmers. The two 6″ pumps were replaced by a larger pump of modern design with 85% efficiency. And the resultant saving in horsepower amounted to 13%! The new pump actually paid for itself in savings in pumping costs. And it's going to keep on piling up savings for years to come!

15% More Water—With Allis-Chalmers Engineering!

If your pumps are more than ten years old, you can cut your pumping costs. Replace them with up-to-date, improved Allis-Chalmers Centrifugal pumps. You can get the savings that increased efficiencies offer. You can get as much as 15% more water for your money!

And that's only part of the story! You get engineering . . . testing . . . research . . . Allis-Chalmers facilities that insure the right pump for the right job! You get undivided responsibility for both pump and drive!

Find out how you can cash in . . . save dollars in pumping costs. Call the Allis-Chalmers representative near you. There's an Allis-Chalmers man . . . a trained pump engineer . . . who can get you more for your money . . . show you how to save dollars in pumping costs!

930

CENTRIFUGAL PUMP DIVISION
ALLIS-CHALMERS
MILWAUKEE-WISCONSIN

SINGLE-STAGE DOUBLE-SUCTION PUMPS • CLOSE-COUPLED SINGLE-STAGE SSUnit PUMPS • MULTI-STAGE PUMPS • PAPER STOCK PUMPS • MIXED FLOW AND AXIAL FLOW PUMPS • AND SPECIAL DESIGNS FOR UNUSUAL APPLICATIONS

Operating Shorts

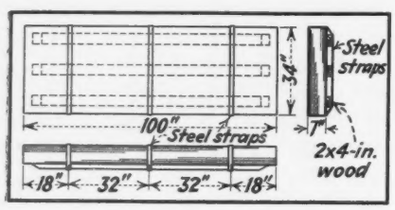
Magnet Prevents Damage in Handling Sheet Steel

SOURCE, *The Ohio Electric Mfg. Co. Cleveland*

Deliveries of sheet steel are made to our plant in bundles which are handled by an electric hoist on a monorail. For years we used chains to lift the bundles, and could not avoid damaging a number of sheets

at each lift. To unload a shipment of 20 tons normally required the labor of three men for one and one-half to two hours.

Some time ago we adopted the method of packing shown in the drawing, which improved conditions somewhat since it keeps the bundles flat and makes it easier to attach the clamps for lifting. A copy of this



drawing is sent with each order. The bundles are 34 in. wide and 100 in. long, and weigh about 5,000 lb. Incidentally, this method of strapping adds nothing to the price of the steel.

It was a long time, however, before we realized that a lifting magnet, one of our products, could be used on this job and would save enough time and money to pay a good dividend on its cost. With the magnet shown in the photograph one man unloaded 27 tons of sheet steel in 39 min., including time out to take the picture. This magnet has a lifting capacity of 12,000 pounds.

Photoelectric control does a neat switching job for Armour & Company, Chicago, at a point where carcasses traveling on overhead conveyor have to be directed alternately to two eviscerating tables.

Old Current Transformers Supply Heat for Soldering

THOMAS R. TURNER, *Engineer Washburn-Crosby Company, Buffalo*

Soldering lugs to wire is a common job in our electrical department. Formerly we used an ordinary gasoline torch for this purpose, but starting the torch consumed more time than was required for the actual soldering operation.

Having several discarded current transformers we decided to wire them backwards, that is attach the secondaries to a 110-volt line, and use the single-turn primary (which now becomes the secondary) to supply low-voltage current to a tongtype heater unit. Accordingly, four 50-amp. transformers for which we would have no future use were wired in series on both the primary and secondary sides, as shown.

Current taps for ordinary use are taken from two transformers, the other two acting as reactance coils. For heavier work the lead can be taken from the third transformer, but this imposes a considerable load on the 110-volt line and in practice two transformers have been found to be sufficient. No. 4 wire was used for the secondary leads to the tongs.

A primary switch was located in a convenient position and the transformers were fastened to the wall over the workbench. The voltage is very low; so insulation was a minor problem. One layer of friction tape on each handle of the tongs was enough.

Two leads were also taken from one transformer to be used for flat soldering. One lead is grounded to the piece to be soldered and the other is attached to a copper bar with a piece of carbon at the end. This makes a good soldering "iron" for flat work.

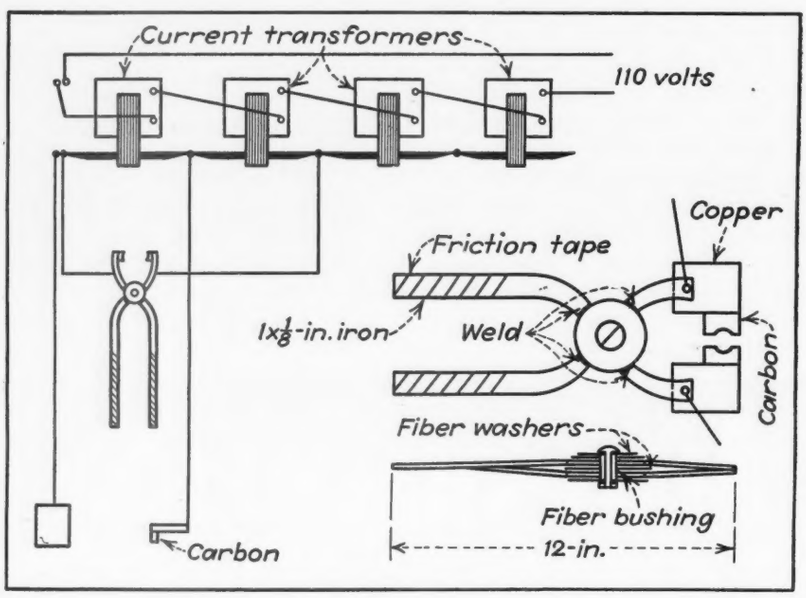
With this equipment, lugs can be soldered or unsoldered in less time than the torch requires to warm up.

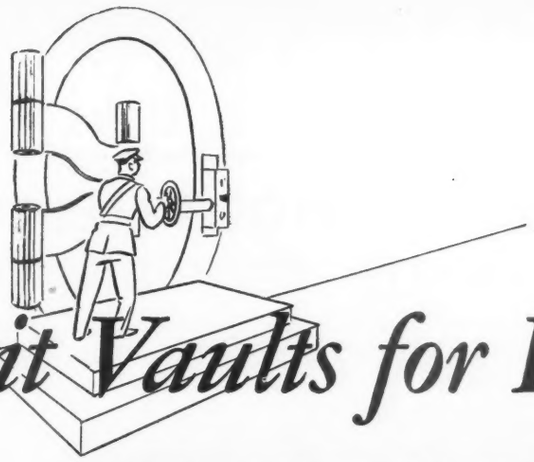
•

Handy Lifting Device for Inside Gripping

CHAS. H. WILLEY, *Penacook, N. H.*

Lifting is one of the jobs that is never lacking in maintenance work. If an internal hitch is needed, or would make some of these jobs easier, the device shown in the sketch





Safe Deposit Vaults for Eyes...

DURALITE-50 GOGGLES

Your working assets... the trained eyes of skilled men... are in safe deposit when they're behind Duralite-50 Goggles. Then flying chips can't rob you of the profits earned by eyes... can't tax you stiff sums in compensation and the many hidden, uncontrollable costs of eye-injuries.

No matter from what direction a chip may strike, Duralite-50 Goggles are on guard. From the front, impact is resisted by the extra strength of Super Armorplate Lenses. At top, bottom and sides, eyecups fit snugly... leave no vulnerable gaps. Worker is protected on his own job, and against chance chips from other jobs.

Complete comfort is also provided... by round-edged eyecups that are individually molded, thoroughly ventilated. By the adjustable ball-chain bridge. And by the one-piece adjustable headband. It's a matter of a few moments and comparatively few dollars to arrange this profit-saving eye protection for all your men who need it. Call in an American Optical representative.

patented

Duralite-50 Goggles provide 4-way protection against flying chips and glancing particles... from any direction.

AMERICAN OPTICAL COMPANY

Manufacturers, for more than 100 years, of products to aid and protect vision. Factories at Southbridge, Massachusetts. In Canada, Consolidated Optical Company, Limited. Branch offices in all principal industrial centers.

5008

CAUTION

CHOOSE THE RIGHT *METAL* WHEN YOU CHOOSE YOUR FENCE

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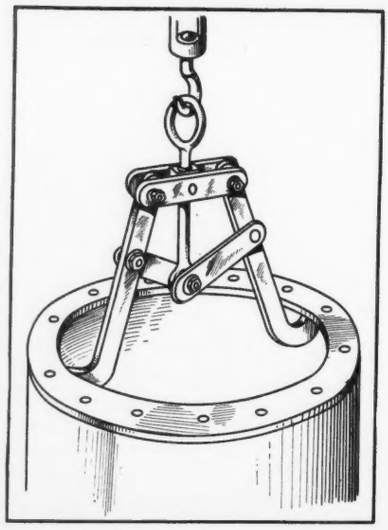

will be well worth making in whatever size suits the need.

As will be seen the device is self-adjusting, the gripping points being free to move in or out as the center lifting eyebolt or connecting rod slides down or up in the center yoke.

The shape of the gripping feet can be made suitable for general work, or it may be designed for a particular application.

Bethlehem Steel Company used a green safety sticker on all plant correspondence in 1937. A pie chart divided into 12 sections showed what safety features would be stressed each month.

Dual Control Levers Protect Machine Operators

L. KASPER, *Philadelphia*

A machine turning out a wire product requires that adjustments be made while it is running. Since the points of adjustment are widely separated, it is necessary that two operators be in attendance. Therefore, it became necessary to install a dual control mechanism so arranged that the two operators are necessary to start the machine, but either one may stop it. The sketches show how this was accomplished.

Figure 1 is a plan view of the operating levers. Figure 2 shows the position of the two levers, *A* and *B*, when the machine is stopped; both levers are in the vertical position, as Figure 3 shows. These levers are free on shaft *K*, being held in position by collars. Shaft *H*, which controls the engagement of the clutch, carries the two levers *G* and *N* (see

Unless variations from standard costs are checked promptly and thoroughly, a standard cost system has little value. The St. Charles Manufacturing Company, St. Charles, Ill., designers and fabricators of modern steel kitchen cabinets and sheet metal products, have cut corners with McCaskey to secure the necessary data without delay. Mr. H. R. Lucas, Cost Accountant, high-spots their results:

"Our plant is operated on a Standard Cost basis and prompt, accurate records are required to measure the efficiency of the various departments in comparison with existing standards. McCaskey Controls give us just that sort of information with a minimum of clerical expense.

"A three copy labor ticket provides data for distributing both productive and non-productive labor departmentally and for accumulating a record of the labor expended on individual manufacturing orders. Variances from standards are thus promptly revealed, localized to the point of origin. The use of another copy of the labor ticket simplifies making-up the pay-roll. All three records are prepared without the multiple postings necessary with most cost and payroll systems.

"Operating department heads and supervisors receive reports promptly, enabling them to detect and rectify existing discrepancies in their respective departments. Information for budgetary control of expenses also is promptly available to the Accounting Department at no additional expense. Many of the problems of effective standard cost control have been simplified as a result of the flexibility of McCaskey Methods.

"McCaskey Perpetual Inventory also has served us well in keeping our stores inventory of several thousand items under proper control. We consider McCaskey a valuable aid in many ways—a modern tool, most effective in the conduct of a modern manufacturing plant."

Standard Costs or Job Costs, either may be provided promptly and dependably *with less clerical labor* with McCaskey. Write for "Cost and Payroll Distributions Without Posting", or pamphlets descriptive of other McCaskey Industrial Controls.

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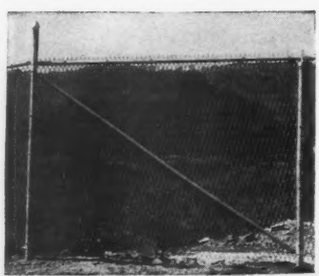
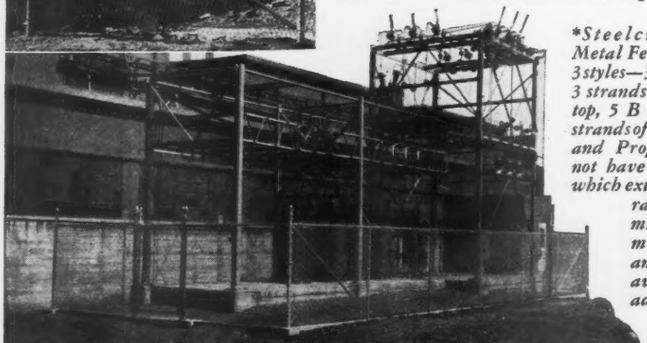
McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

WHEN Steelcrete *Expanded Metal Fence* STANDS GUARD

● Protect property and prevent personal injury damage suits with Steelcrete Expanded Metal Fence! Its rigid, non-sagging, expanded metal diamond mesh is difficult to climb and provides a lasting barrier against intruders. Posts, rails and fabric are rust-resisting COP-R-LOY, heavily galvanized. Steelcrete Expanded Metal Fence is easy to erect. It is supplied in convenient sections which are joined with inconspicuous clips. Its flexibility assures ready adaptability to any contour. Because there is nothing to stretch, except a few strands of barbed wire at the top*, there is practically no tension on the fabric or posts. Steelcrete Expanded Metal Fence serves longer and at lower maintenance costs. Write the nearest address below for complete facts!





**Steelcrete Expanded Metal Fence is available in 3 styles—3 B Industrial with 3 strands of barbed wire at top, 5 B Industrial with 5 strands of barbed wire at top and Property which does not have barbed wire but which extends above the top rail providing a formidable barrier. Removable panels of any required size are available at slight additional cost.*

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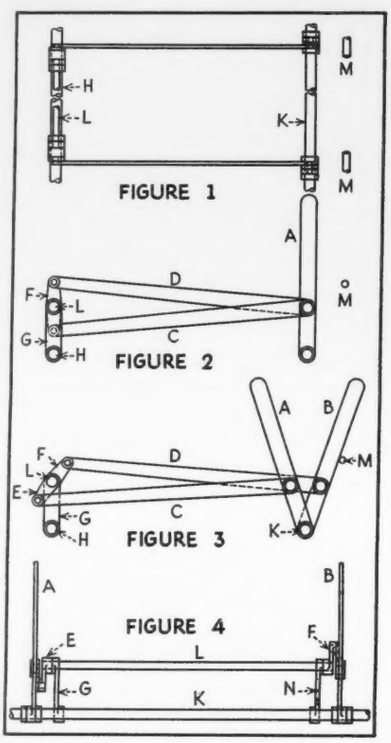
end view, Figure 4), which are keyed to shaft *H*. Levers *G* and *N* carry the oscillating shaft *L*, to which levers *E* and *F* are keyed. They are set diametrically opposite each other. Rod *D* connects lever *F* with lever *B*, and rod *C* connects lever *E* with lever *A*.

To start the machine, one operator pulls lever *B* forward against the stop, *M*. This causes rod *D* to transmit the movement to lever *F*, and since shaft *L* is free to rotate in levers *G* and *N*, it makes a partial revolution. Movement of shaft *L* causes lever *E* to swing to the rear, drawing lever *A* with it, through rod *C*. Up to this point, no movement has been transmitted to shaft *H*, and clutch engagement has not been accomplished.

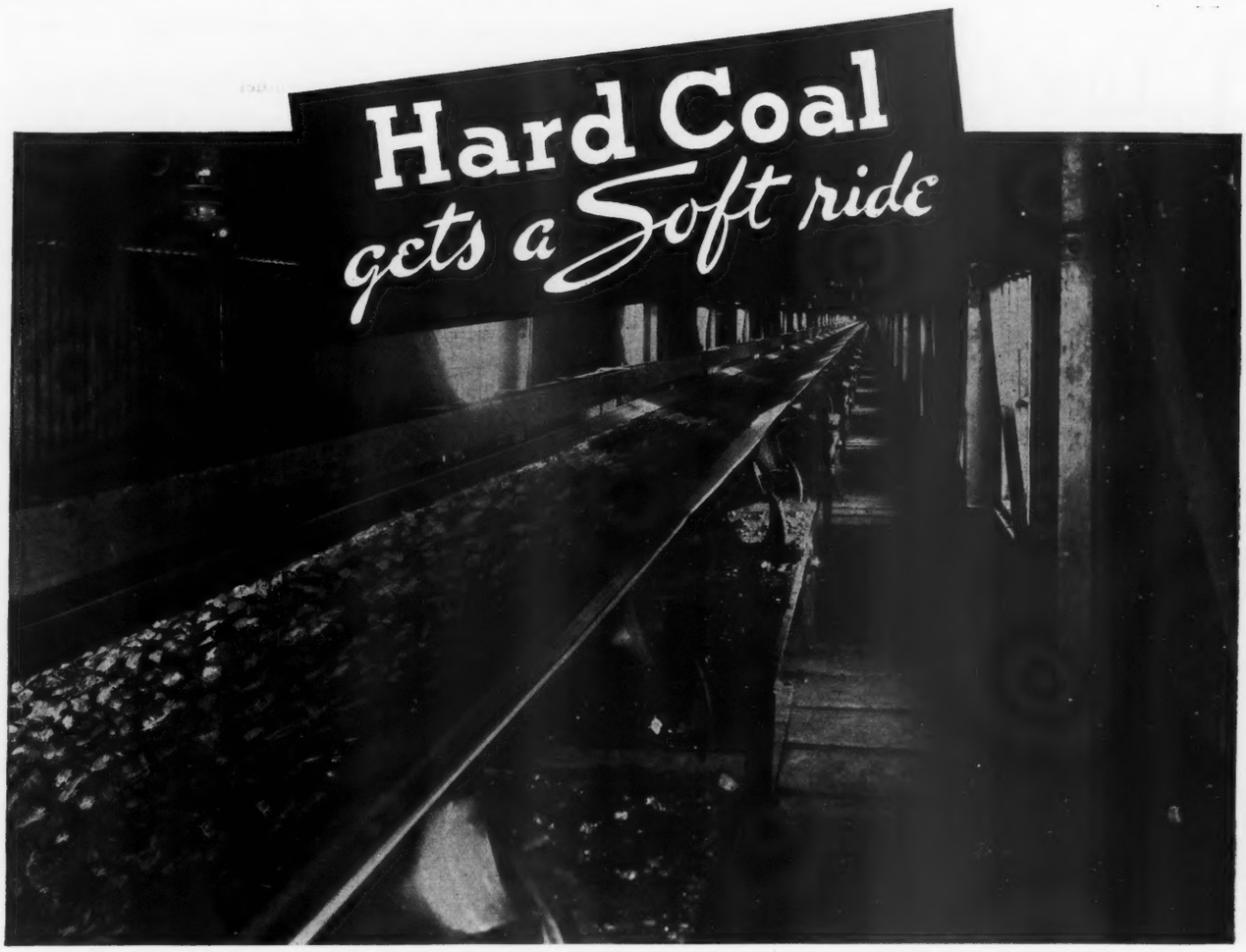
While lever *B* is held against stop



M by the first operator, the second pulls lever *A* forward. This causes levers *E* and *F*, acting as one, to oscillate on the stud on the upper end of lever *F*. Thus, levers *E* and *F* act as one lever operating second class, so that the shaft *L* is drawn forward, its motion transmitted to shaft *H* through levers *G* and *N*, causing the clutch to be engaged.

When the clutch is engaged it may be disengaged by pushing back either *A* or *B*.

If levers *A* and *B* are pulled forward simultaneously the same effect is produced, but in no case can the machine be started without manipulation of the opposite lever. Nor is



Thermoid offers a complete line of beltings including the following standard types

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- Transmission Belting
- Grader Belting
- Canners Belting
- Bucket Elevator Belting
- Grain Elevator Belting
- Agricultural Belting
- Hog Scraper Belting
- Endless Thresher Belting
- Oil Country Belting
- Axle Lighting Belting

For more detailed information on Thermoid Industrial Rubber Products, refer to Sweet's Catalog File.

Coal is given a long, easy ride at the Dorrance Colliery of the Lehigh Valley Coal Co., Wilkes-Barre, Pa. Here is a 7-ply conveyor belt, 630 feet long and 43 inches wide, which daily carries hundreds of tons with little sign of abrasion or wear.

It's *knowing how* and *why* that enables Thermoid to build products that do the job, no matter how tough, and do it well. Thermoid has learned *how* in the factory and *why* in the field during 56 years of hard-earned experience.

Why not give Thermoid products a chance to prove how well they can do your particular job? Your supply house can deliver them promptly, and our engineers are always at your service in solving unusual problems.

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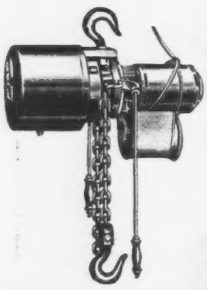

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Cap.	No load	Full load	Price Hook Type	Price Trolley Type
With 110-220-440-550-volt 3 phase or 2 phase 60 cycle motors				
500 lbs.	32′ per min.	same	$148.	$159.
1000 lbs.	16′ per min.	same	159.	173.
2000 lbs.	8′ per min.	same	170.	187.
4000 lbs.	4′ per min.	same	225.	249.
4000 lbs.	9′ per min.	same	300.	327.
6000 lbs.	9′ per min.	same	390.	424.
With Universal (single phase A.C. or D.C.) 110 or 220 volt motors				
500 lbs.	38′ per min.	28′ per min.	$165.	$176.
1000 lbs.	20′ per min.	12′ per min.	176.	190.
2000 lbs.	10′ per min.	6′ per min.	187.	203.
4000 lbs.	5′ per min.	3′ per min.	265.	289.
4000 lbs.		9′ per min.	340.	367.
6000 lbs.		9′ per min.	450.	487.

Also Ball Bearing Spur Gear Hand Chain Hoists at Comparable Prices.

McCOLLUM

HOIST MFG. COMPANY

4818 Saratoga Avenue

Downers Grove, Illinois

it possible for one operator to start the machine by pulling one lever and then walking to the other side of the machine and moving the other lever, because this merely causes shaft *L* to oscillate in levers *G* and *N* without transmitting any movement to the clutch shaft, *H*.

Vibration threatened to destroy instruments on a temperature-control panelboard. Vibration-damping devices under the panel saved the day.

Radio Music Helps to Keep Employees Contented

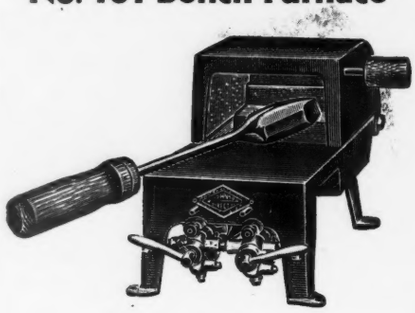
SOURCE, *Wholesale Radio Service Company, Inc., New York*

A seven-tube radio receiving set with 30-watt amplifier unit and six loudspeakers help 300 employees in a large dry cleaning plant to perform their work, which is of a repetitive character, in a more efficient manner and with less fatigue. The total cost of the installation was approximately $250, but one of the executives has said that if the cost of the equipment were ten times as much, they would not hesitate to install it since it has resulted in a more even-going and contented personnel.

Seven years ago, when this plant was only a fraction of its present size, the need was felt for something to bolster the morale of the men when they were requested to work overtime during peak seasons. A small portable radio set was tried out and had very beneficial effects, lessening fatigue and increasing production.

Accordingly, two loudspeakers were installed and a set was operated for several hours each day, to offset fatigue periods. A distinct let-down in the work was noticed when the music was stopped. After a trial period of

Do Better Work at Low Cost with JOHNSON No. 101 Bench Furnace



Modernize your shop with JOHNSON No. 101 Bench Furnace and you'll get years of trouble-free service at low cost. It is the most widely used bench furnace made. Designed for heating soldering coppers up to 12 lbs. per pair, heat treating, tempering, annealing or case hardening small metal parts, such as dies, gears, and chisels. The patented JOHNSON Direct Jet Bunsen Burner develops intense heat without blower or forced air blast. Many exclusive features. Write for free catalog today.

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WHEN NEEDED MOST

Pyroil's efficiency is most notable when emergencies arise. Pyroil takes the shock load and protects the equipment. Often, severe damage, shut down or heavy expense is offset because Pyroil was "in there", protecting vital working parts.

Pyroil has been safeguarding equipment for many years in all parts of the world. Test it in your plant. Call our Distributor. Or write. Pyroil Company, W. V. Kidder, Founder, 675 LaFollette Ave., LaCrosse, Wisconsin, U.S.A.

Announcing THE NEW ACME NO. 2 *Steelstrapper*

"This magazine holds 50 seals — saves the time required to feed 50 seals by hand."
"On both large and small packs the Steelstrap is easily and properly tensioned by this lever."
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"This trade-mark is a sign of maximum Steelstrap joint strength and economy."
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"Mail this coupon for further information about the new Acme No. 2 Steelstrapper and a copy of 'My Second Strap Book'."

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● Now ready! the latest addition to the only line of strapping equipment which *combines* the tensioning, sealing and cutting operations with an automatic seal feed. Made to eliminate lost motion and provide additional economies, the new Acme No. 2 Steelstrapper is built for speedy steelstrap application to heavy packs including skid loads.

Whether you ship in cartons, boxes, crates, bundles or on skids, there is a size of Acme Steelstrap and an Acme Steelstrapper to help you make important savings for your company. Let Doc Steelstrap figure the exact amount you can save. Mail the coupon today. No obligation.

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He will solve your Paint-Spraying problem either with standard DeVilbiss Equipment★ or with a specially designed installation to meet your particular requirements. This is only *one* phase of DeVilbiss Service. Another is to make sure that every piece of DeVilbiss Equipment in your plant makes money—for you!

DeVilbiss men are thoroughly trained in every detail of modern Spray-Finishing—the production, cleaning, and regulation of air—the feeding of material and air to the gun—the ventilation of the finishing area.

Right now is a good time to install new, better, more economical Spray-Finishing Equipment. DeVilbiss Experts will help you with the planning. Write, wire, or 'phone! No obligation! The DeVilbiss Company, Toledo, Ohio.

★ The most advanced type of spray-painting and finishing equipment, exhaust systems, air compressors, hose and hose connections.

DE VILBISS SPRAY SYSTEMS

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operating the set continuously, the employees voted practically unanimously for the continuous playing of music except during the lunch period.

The music is played with sufficient volume to overcome the noise of the machinery, but not so loudly as to be objectionable. All controls including station selection, volume, and loudspeaker switches, are in the manager's office in the center of the production floor.

Since the purpose of installing the radio equipment was to reduce the fatigue and improve working conditions, the program is arranged to include all types of music. Popular airs are played mostly. However, some classical selections are interspersed to add variety.

The employees seem to listen to the music subconsciously. For the first few days after music has been introduced into a shop, it is somewhat distracting but this effect soon wears off. In this plant the radio music has produced very tangible benefits in improved labor conditions. Formerly there was excessive talking and loitering in the washrooms. This problem has been practically eliminated.

News and talking programs require active attention and since it is not possible for the workers to do two things well at the same time, such programs are never tuned in during the day. However, during overtime periods in the evening programs of national interest are broadcast.

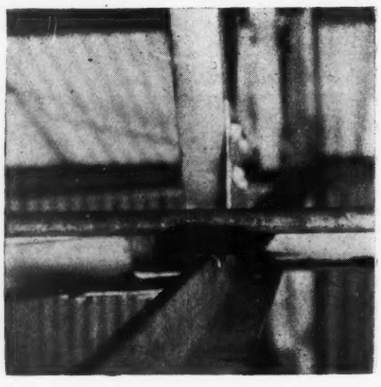
•

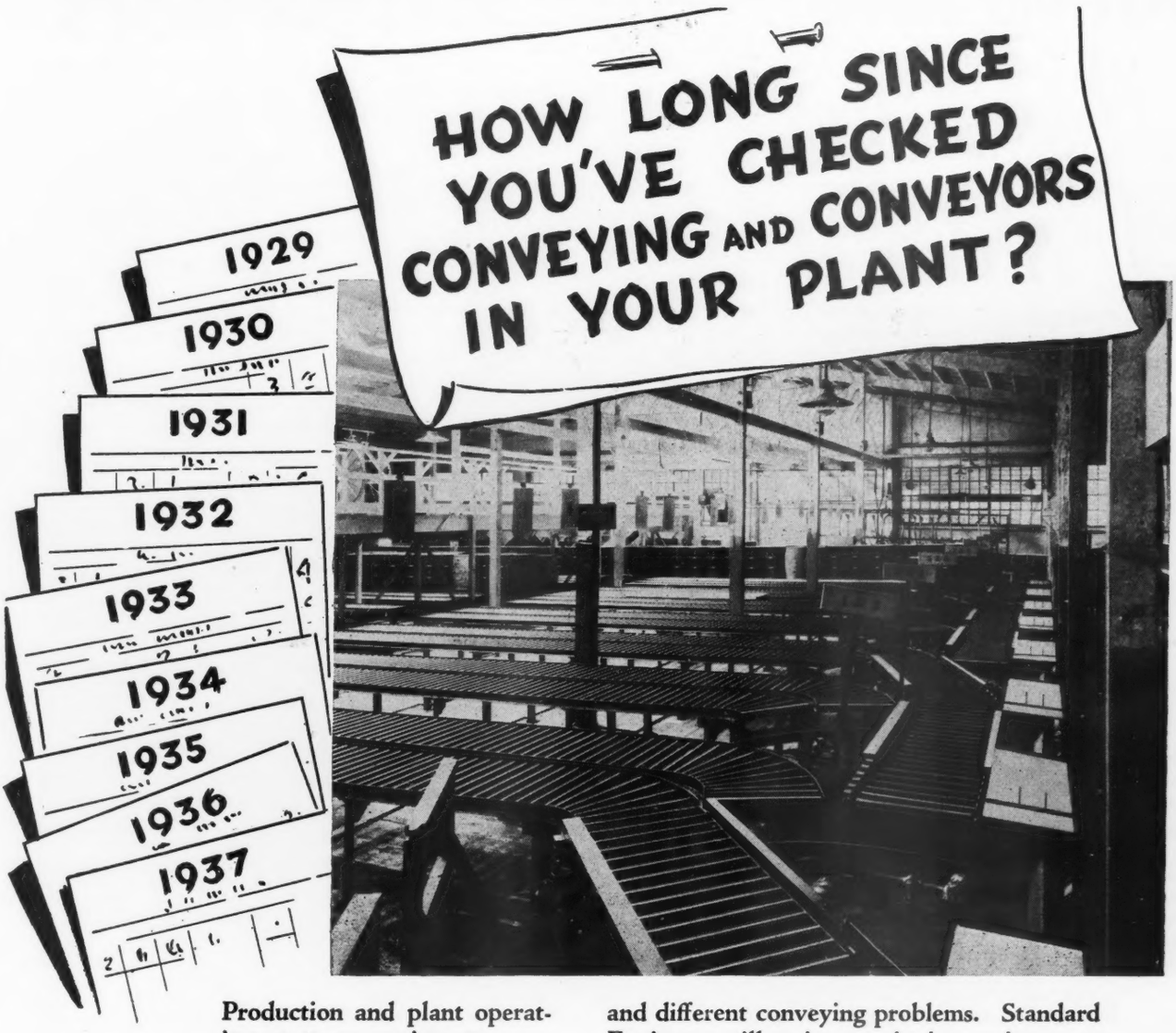
Shock Absorber for Truss-Supported Conduits

ELTON STERRETT, *Longview, Tex.*

Building vibration, set up by reciprocating machinery on the concrete floor and thence transmitted to the structural building, was blamed for the rapid failure of the 200-watt bulbs used in pendant, vapor-proof lighting fixtures.

Conduits carrying the lighting circuits were laid on top of the hori-





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Give your conveying methods and conveying equipment a thorough "once-over" . . . discard costly, obsolete apparatus . . . check for needed replacements and improvements . . . plan material handling to speed production and lower costs.

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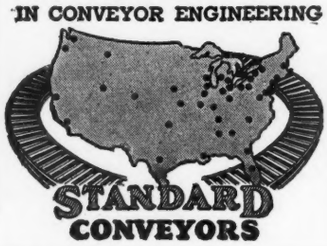

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zontal members of the roof trusses, and wired there to prevent shifting. These clamping wires were cut in an attempt to relieve the conduit of the vibration, but the life of the bulbs continued to check at less than 25 per cent of the normal service period.

A shock absorber was devised by cutting a 6-inch-wide channel of ⅛-in. metal into 6-in. sections, and welding to the back of each channel section one half of a ¾-in. pipe coupling, which had been divided the long way by sawing lengthwise.

Into the wide U-shaped section a piece of ¼-in. fabric-reinforced gasket rubber was fitted, large enough to overlap 1 in. in each direction. Two of these rubber-covered retainers were then fitted together like a pair of clasped hands, one split pipe coupling being set over the upper edge of the roof truss angles, the other supporting the conduit.

Careful check of light replacement showed that, once the bulbs that had been in service prior to the shock absorber installation had been renewed, normal lamp life might be expected—the savings in replacements clearing up expense of the absorbers within the first two months.

If only small parts of fuse clips make contact with fuse terminals, fuses can't carry their rated load, will heat up. Better check them.

Knife Switch Maintenance

S. H. COLEMAN, *Roanoke, Va.*

Preventive Maintenance

1. Operate the switch frequently so that contacts do not become oxidized.

2. Protect the switch against mechanical injury. Mount isolated switches in cabinets and protect open-front switchboards with a screen wire enclosure.

3. Avoid causes of overheating such as overloads, poor contact between jaws and blades, dirt, and faulty connections to studs.

4. Protect switches from corrosion. Where switches are exposed to acid fumes, corrosive gases, and smoke, all current-carrying parts should be protected with a thin coat of vaseline. Switches that operate under these conditions necessarily require a greater frequency of inspection than those in more favorable locations.

5. Never open a plain-break knife

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Practically every mail brings inquiries and suggestions for new uses of General Jumbo Jrs. The possibilities of this pioneer industrial tire, tube and wheel combination are endless. If you have hand operated or motorized industrial equipment, investigate Jumbo Jrs. Write for more detailed information and list of manufacturers supplying equipment on Jumbo Jrs.

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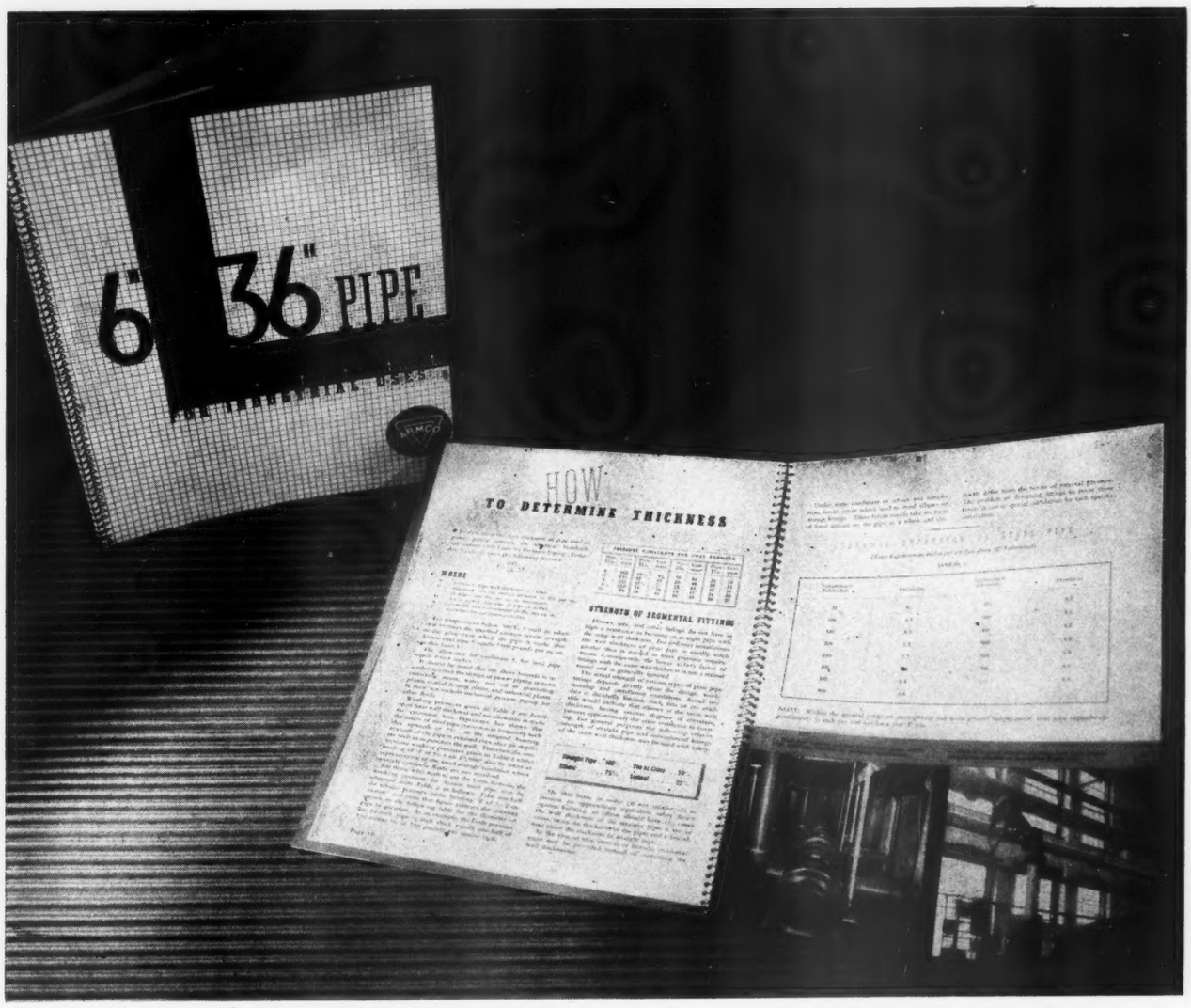

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Far from being "just another advertising catalog," this new 42-page book is packed with helpful information. Supplemented by large, easy-to-use tables and charts, it explains how to determine pipe wall thickness; how to eliminate unnecessary joints: how to estimate pumping costs. Then too you'll find a wealth of useful data covering protective coatings, various types of joints and recommended methods of installation.

Send for a copy of this handy industrial pipe book today. Just sign and mail the convenient coupon. The American Rolling Mill Co., Pipe Sales Division, 2371 Curtis St., Middletown, Ohio.

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● Service Lifters, as a simple means of "vertical materials handling", change inaccessible top-of-the-pile space to new storage room, easy, safe and cheap to reach. An inexpensive installation can reclaim space equivalent to a new warehouse. Service Electric Lifter, as shown piling cases, is versatile—will lift barrels, drums, bales—and a selective cable control stops platform invariably at a pre-selected elevation. Other Service Lifters—electric, hydraulic or hand-powered—hoist any product with savings and safety. Write for new catalog.

Service LIFTERS

SERVICE CASTER & TRUCK CO.

505 N. BROWNSWOOD AVE., ALBION, MICH.

Eastern Factory 434 Somerville Avenue, Somerville, (Boston), Mass.

switch when the circuit is loaded. These switches are not ordinarily intended for this service and it is very desirable that starting devices or breakers in series with the switch be opened first.

6. Keep hinge jaws tight. Pins on these jaws should be kept tight enough to insure proper contact but not so tight as to interfere with the easy operation of the blades.

Maintenance

7. Check up occasionally on contact efficiency, recontacting, and the replacement of damaged parts.

8. Replace any parts of the switch that may have become annealed by overheating, as poor contact may in time cause melting or an arc that will put the switch out of service. Annealed switch jaws can be detected when the switch is open by tapping the copper lightly with some insulated object. If the metal rings when tapped it is not annealed. A dull sound, however, indicates that the copper has become annealed and should be replaced.

9. Watch jaws or blades damaged by arcing to be sure enough copper contact area remains to take care of the maximum load that might be imposed on the switch. If there is any doubt, renew the damaged parts.

Recontacting

When recontacting is necessary:

10. See that no current is flowing in any part of the switch. If this is impossible, take every precaution to prevent injury to workmen and short circuits that might damage switch parts.

11. Line up outsides of hinge and jack blades so that they are in the same plane. This alignment may be checked by placing a straight-edge against the blade surfaces. If the switch is dead, a steel scale may be used; if alive, a straight-edge made of some insulating material. Should the hinge or jaw blades be out of line, they can be tapped into place with a machinist's hammer, using a fiber block against the copper to prevent scarring it.

12. With the switch closed, check the contact area between knife and jaw blades with a 0.0015-in. feeler.

a. If jaw blades are not parallel, twist them into position with a slotted tool. This tool must be made so that it will fit between the blades with enough clearance to prevent the twisting of one blade from affecting the adjacent blade.

b. Inward bows in the jaws can

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● Made up of individual plates 18" wide and any length necessary to span the distance between purlins, the Wheeling Tri-Rib Steel Roof Deck can be quickly and easily applied. The plates are attached to the purlins and to each other by clips or welding. Pre-fabricated to the right dimensions for the job, they require no cutting or fitting. Their overlapping ends never have to be forced in place. All of the assembly work is handled from the top of the deck. No scaffolding required. The flat, smooth surface is ready to receive insulation and roofing as soon as the assembly is completed. Made of COP-R-LOY —Wheeling's famous rust-resisting copper alloy painted or galvanized, the Wheeling Tri-Rib Steel Roof Deck assures dependable service at lowest maintenance costs. Catalog on request. Address the nearest office listed below.

Wheeling
CORRUGATING COMPANY

Tri-Rib
STEEL ROOF DECK

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WHEELING CORRUGATING CO.
WHEELING, WEST VIRGINIA

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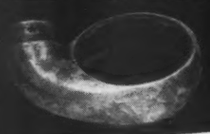
INTERESTING CLEANING DISCOVERIES THAT LED TO IMPORTANT PRODUCTION SAVINGS

#1 ALUMINUM CASTINGS



THE PROBLEM

To thoroughly clean buffed aluminum castings without tarnishing or spotting . . . *at less cost.*

THE ANSWER

A simple 1-minute dip in a cold-tank solution of MAGNUS No. 78 and water, followed by a cold water rinse.

The above actual case history shows how MAGNUS EMULSION DEGREASING SOLVENT No. 78 enabled a large Eastern manufacturer of electrical appliances to completely eliminate hand scrubbing from cleaning buffed aluminum castings. Previous to using MAGNUS No. 78, more labor was required on that one time-wasting, profit-eating item than on any associated operation in the production line. MAGNUS No. 78, used *cold, completely eliminated* that expensive item and, in addition, showed other important savings. Let us show you how MAGNUS EMULSION DEGREASING SOLVENT No. 78 will cut your cleaning costs, give you better cleaning . . . and otherwise materially increase your profits. Write today for a demonstration *under your own working conditions.* Or, send us the details of your cleaning operations for our specific recommendations.

HAND SCRUBBING ELIMINATED

A DEFINITE DAILY SAVING IN THE COST

MAGNUS CHEMICAL COMPANY

Manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants.

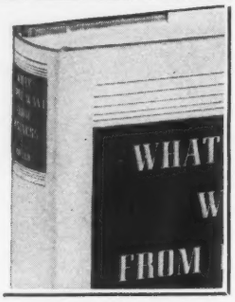
220 South Avenue Garwood, N. J.

MAGNUS CLEANERS

Use this exhaustive study of how the worker feels and thinks

—to improve morale
—to discover causes of unrest and dissatisfaction

Just Out!



WHAT PEOPLE WANT FROM BUSINESS

By J. David Houser—$2.50

IN this book the author uncovers factually and convincingly some startling truths about what the worker really wants from his job. He found that pay is *not* the most important desire of workers, that policies and practices which interfere with employees' getting results have greater power to affect general attitude than have those which affect their immediate self-interests.

The book shows plainly that decline of profits is often only the graphic indication of what is happening to morale, that the sum total of injured sensibilities make up by far the largest part of the sinister phenomenon of industrial unrest. All who are interested in the business problems of this country—whether from management's, labor's, or the consumer's viewpoint, will find this book revealing.

EXAMINE THIS BOOK 10 DAYS ON APPROVAL — SEND THIS COUPON

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C.

Send me Houser—What People Want from Business for 10 days' examination on approval. In 10 days I will send $2.50, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

Name .....

Address ..... Position .....

City and State..... Company ..... Fac. 7-38

(Books sent on approval in U. S. and Canada only.)

be straightened by placing a round pin, having a diameter equal to the thickness of the blade, between the jaws, and then squeezing the outer ends of the jaws together with a pair of pliers. Wrap friction tape around ends of the pliers to prevent damaging the copper, or use fiber pliers.

c. Outward bows are straightened by pulling the switch blades outward until the bottom edges are just between the jaw tips, and then hammering the bow inward with a hammer having a lead, rawhide or fiber face.

13. To grind in the switch contacts, apply vaseline mixed with scouring powder or pumice to the blades and jaws, and then operate the switch as many times as is necessary to make contacts right. Never use valve grinding compounds, emery powder, or other hard abrasives as they tend to scratch and become embedded in the copper, interfering with proper contact. Before the switch is put into operation, the grinding mixture must be entirely removed and the surfaces smeared with clean vaseline.

General

14. When maintaining a switch always see that the operating handles, insulated crossbar, base or panel, barriers, and enclosure are in good condition. In the case of overhead-mounted disconnecting switches check up on the operating pole.

15. Examine all connection studs and terminals for any faults that might cause poor contact.

16. See that panel or base is kept clean. Slate, steel or composition bases and panels can be cleaned with chamois skin dipped in lukewarm water or by rubbing with slightly oiled waste or rags.

17. After a repaired switch is placed in operation it must be closely watched for several days to detect any indications of faulty maintenance.

•

Rolling Cafeteria

Bernard Heller, *Formerly Office Manager and Personnel Agent, Puritan Weaving Company, Fayetteville, N. C.*

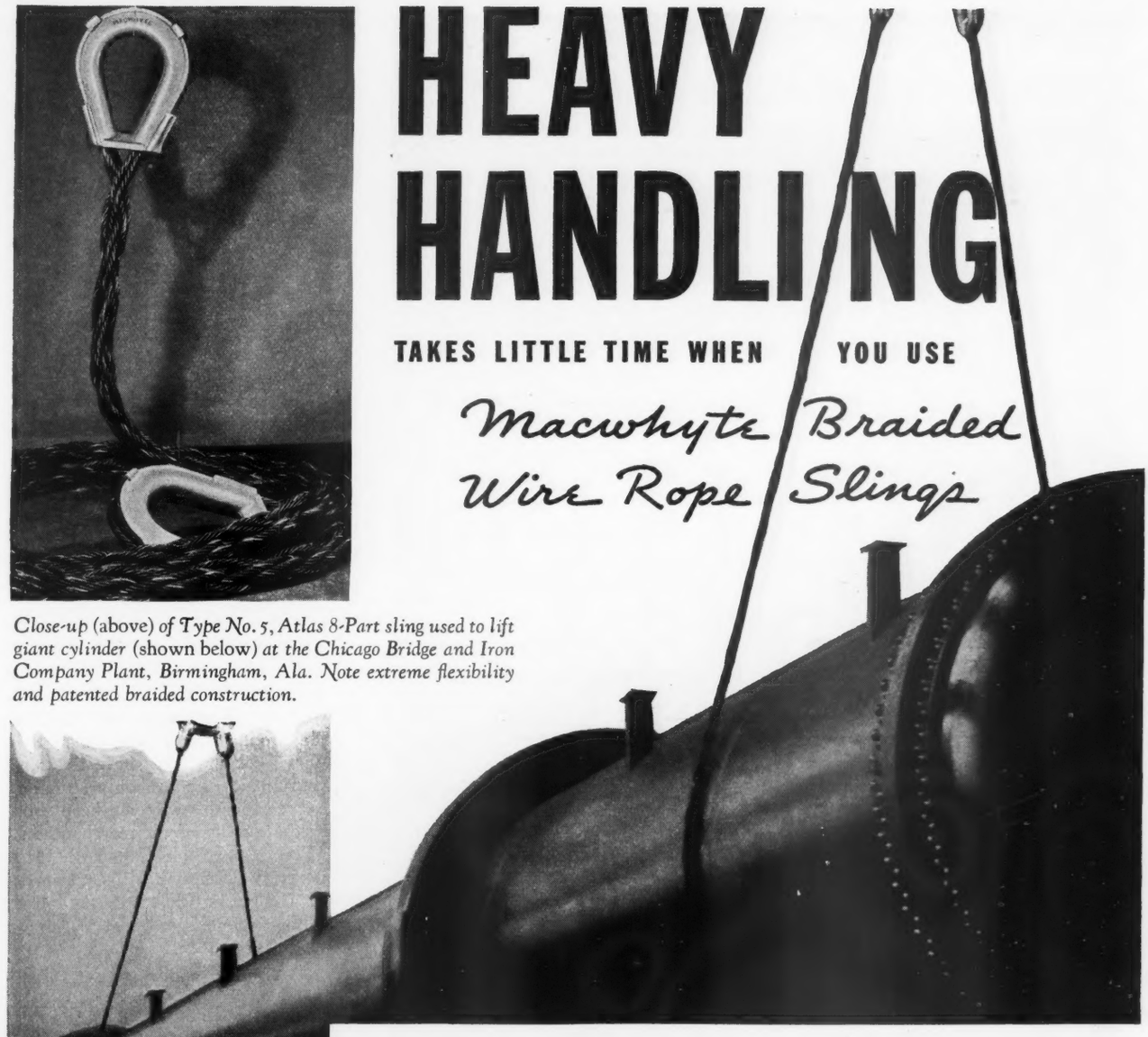
This eating problem is one that besets most plant managers. The rolling cafeteria proved to be our solution.

Take this mill with its 400 people, mostly on automatic machines. The rubber-tired cart made six trips a day. Employees bought what they liked without leaving their machines.

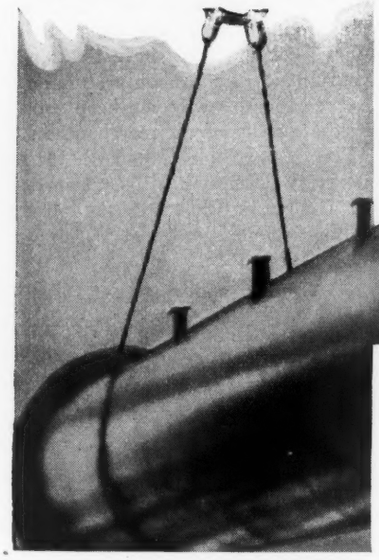
HEAVY HANDLING

TAKES LITTLE TIME WHEN YOU USE

Macwhyte Braided Wire Rope Slings



Close-up (above) of Type No. 5, Atlas 8-Part sling used to lift giant cylinder (shown below) at the Chicago Bridge and Iron Company Plant, Birmingham, Ala. Note extreme flexibility and patented braided construction.



● A bulky, heavy load, with a smooth, hard-to-grip surface . . . yet this 75-TON creosoting cylinder is lifted easily, and safely by means of Macwhyte Braided Wire Rope Slings.

Slings Attached Quickly

It's difficult, until you use them, to realize the ease and speed with which Macwhyte Slings can be attached to any load. Being extremely light-weight and flexible, they are put around any sized load in a few moments. Once in position and drawn taut, they hug the load tightly, with no chance of slipping.

Do the Job Safely

The special braided construction of these slings, a Macwhyte patented feature, gives them *unusual* flexibility. Fabricated with right and left lay endless ropes, they are safe beyond comparison. Furthermore, this construction lengthens their service life.

Macwhyte Braided Wire Rope Slings are the choice of hundreds of manufacturers today because, day after day, they do the job quickly, safely, and economically.

Write for pictorial, on-the-job, booklet "How To Handle Loads Safely." Shows how leading manufacturers use Macwhyte Slings to handle materials with greater speed and safety at lower cost. WRITE FOR BOOKLET TODAY!

MACWHYTE COMPANY
KENOSHA, WISCONSIN

Manufacturers of Wire Rope and braided wire rope slings.
Distributors throughout the U. S. A.

Member National Safety Council

NO. 352

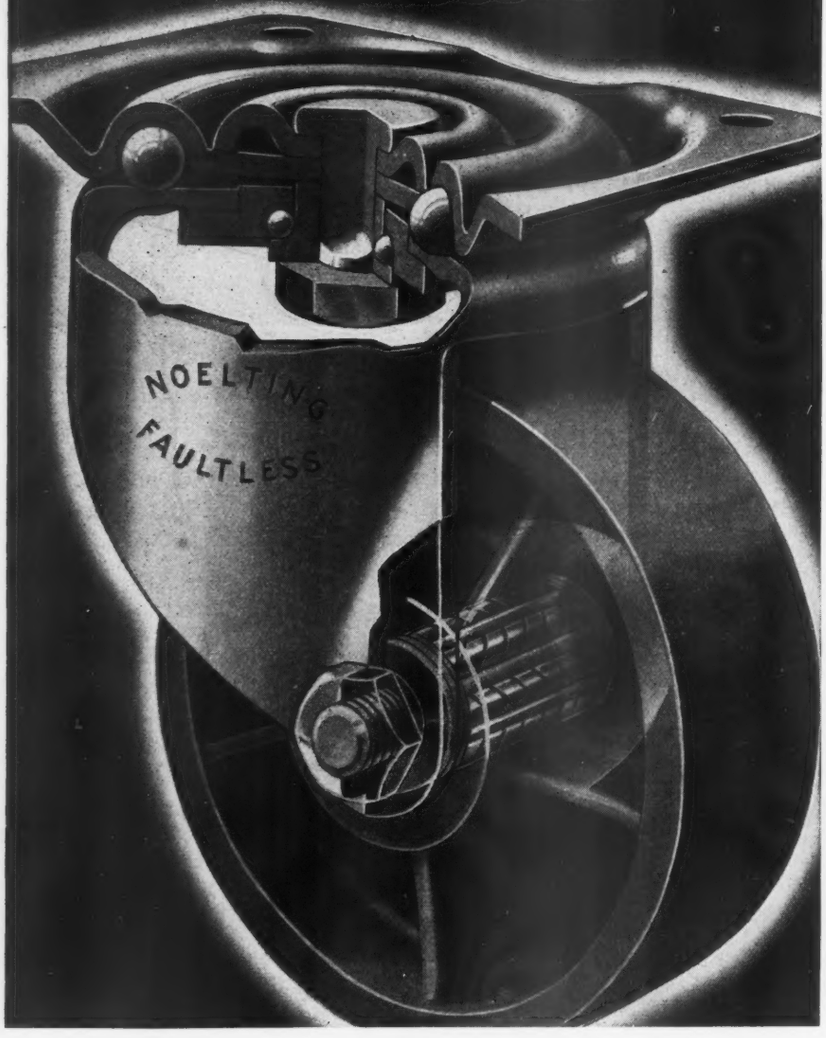
MACWHYTE
Braided **WIRE ROPE** *Slings*

Today's operating profit more than ever depends on *EFFICIENCY!*

With shortened hours for men and machines, operations of all kinds must reach new peaks of efficiency. In no place is modernization of equipment more necessary than on moving assembly and production lines. Breakdowns and delays cannot *and need not* be tolerated. Simply revamp and replace with Faultless Casters such as No. 200 Heavy Duty Truck Caster illustrated. Double ball-bearing swivel, Hyatt roller bearing, semi-steel wheel. Frictionless, exceptionally strong and durable. Sold by leading distributors everywhere.

FAULTLESS CASTER CORPORATION, Dept. FM-7, Evansville, Ind.
Branches in Principal Cities • Canadian Factory: Stratford, Ontario

FAULTLESS CASTERS
FOR INDUSTRY



Thus they got the extra lift that the between-meals sandwich or candy bar is supposed to impart.

One man handled this service. Receipts in this mill averaged $300 a week, of which $60 was net profit. Annual profit was in the neighborhood of $3,000 a year—about $7.50 per employee. To which the mill added $5 per employee. At Christmas each got $10—and the balance was used to give a big party for all workers and their families.

It goes almost without saying that Puritan employees liked this idea. Fortunately it is one that any concern can use. It is a lot better to run your own food service and turn back the profits to employees, than to let Tom, Dick or Harry have the run of your plant with probably an inferior service. In this way you keep control of the quality of the merchandise.

The photograph happened to be taken at Cramerton Mills, Cramerton, N. C., but it illustrates the type of rolling cafeteria used at Puritan.

Sloping windows must be cleaned more often than vertical ones, for dirt collects on them faster.

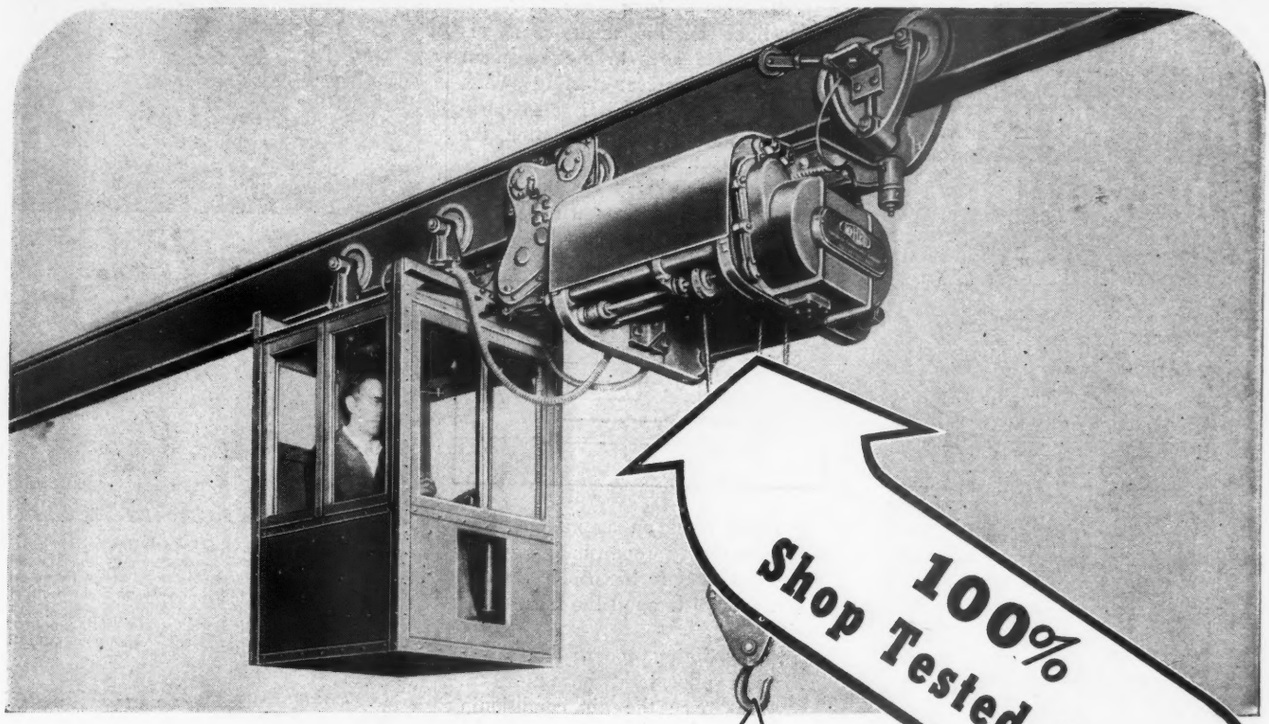
Reset Buttons Get Prompt Attention

NORMAN C. MULLER, *Oberlin, Ohio*

The enclosed sketch shows a time and money saver for remote-controlled equipment. We have used it effectively in restaurants on refrigerating and air conditioning equipment, in dairies, and in ice cream plants, and it should find many applications in other industries.

Two small lamps are connected in series across the thermal overload switch. One is placed on the panel at the machine, the other at the remote control switch connected to this machine. For example, in a restaurant the chef, who knows nothing about refrigeration, notices that the

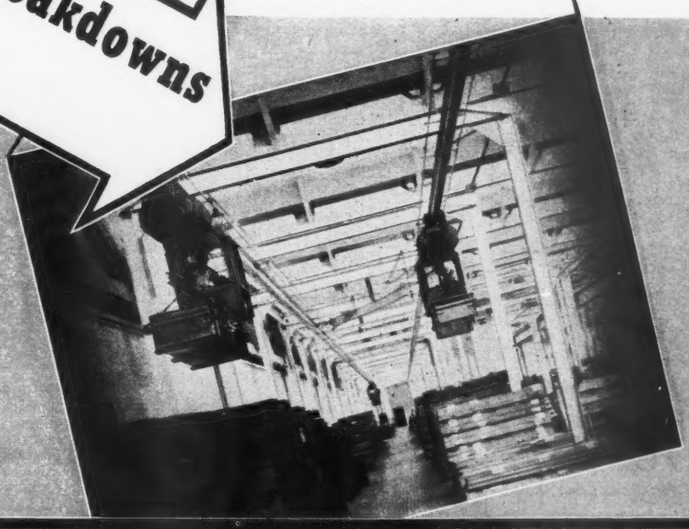
(Continued on page 118)



100% Shop Tested Here

Be sure you order THE hoist that is *thoroughly* tested under actual operating conditions before it is shipped. Let the nearest A-E-CO representative* explain how the shop-testing of Lo-Hed Hoists assures reliable performance in your plant. Ask him to explain Lo-Hed's exclusive features that give you fast, dependable operation with minimum maintenance cost. Let him show you Lo-Hed's uses in scores of industries. Find out *why* Lo-Hed is the logical hoist for EVERY purpose and why it is the *only* hoist for low headroom conditions. A-E-CO Lo-Hed Hoists are built in 98 standard models—from ¼ to 12 ton capacities.

To Prevent Breakdowns Here



**Classified phone directories list the local A-E-CO representative in principal cities. Call him in . . . or write us for the new hoist catalog. This catalog clearly shows you how to select the specific hoist for your requirements.*

Other A-E-CO Products: Taylor Stoker Units • Marine Deck Auxiliaries • Hele-Shaw Fluid Power.

A-E-CO Lo-Hed HOISTS

AMERICAN ENGINEERING COMPANY

2426 ARAMINGO AVENUE, PHILADELPHIA, PA.

WRITE FOR THESE VALUABLE FREE BOOKS

Without any charge or obligation we will send you a copy of these interesting catalogs. They illustrate and describe hundreds of hand, platform and lift-jack trucks, casters, wheelbarrows, etc.—a type and size for every purpose.

These are not just catalogs, but tell how to reduce installation costs, state the type of equipment that will handle different products most economically and give much other valuable information.

You cannot afford to be without these large catalogs. Send for them today, stating whether you are interested in hand trucks, platform trucks, casters or wheelbarrows.

The Fairbanks Company

Hand Trucks, Wheelbarrows, Dart Unions and Valves

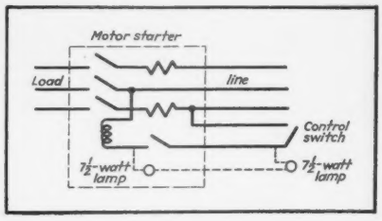
EXECUTIVE OFFICES:

401 Lafayette St., New York, N. Y.

Boston, Pittsburgh • Distributors in Principal Cities
Factories: Binghamton, N. Y. Rome, Ga.

(Continued from page 114)

pilot light on his meat cooler is burning. He goes to the basement and finds the correct starting switch because the light on it is also burning. He pushes the reset button, the machine starts, and the pilot lights go out. If they stay out, he knows there has been just a harmless overload or a fluctuation in voltage. If



the lights come on again, he knows he must call a repairman, and can do so long before his cooler becomes warm enough to spoil the meat stored in it.

In the dining room, the cashier notices a pilot light burning. She knows at once the air conditioning system has shut down due to trouble. In the ice cream plant, the operator does not churn his mix for fifteen minutes needlessly. If the compressor or brine pump shuts down he knows at once. For the electrical repairman it means no wild goose chases to push a reset button.

•

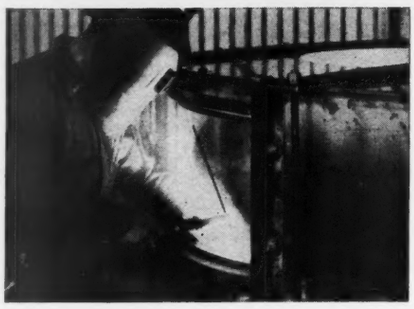
Ten Appeals a Supervisor Can Make

MERRITT LUM, *Daniel Starch and Staff New York*

Looking at the problem from the standpoint of direct contact between supervisor and worker, here are ten characteristics to which a supervisor can appeal in an effort to stimulate interest and effective workmanship:

1. Pride in good workmanship.
2. Spirit of competition.
3. Desire to "beat the record."
4. A man's creative mind.
5. Desire for friendship and comradeship in the work.
6. A man's desire for recognition by his fellow workers and acceptance by them of him as a contributing member of the gang.
7. Instinct of self-preservation, or preservation of the job.
8. A man's love of his home and family.
9. A man's pride in personal accomplishment, and his willingness to demonstrate the best he has in him.
10. Desire for praise and commendation for good work.

Come to Experts

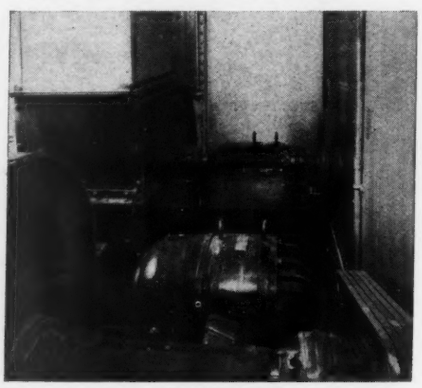


14,500 FEET OF WELDING ON 36 FANS — One certain process in a large chemical plant demands conditioned air almost microscopically clean. Clarage furnished the fans for this exacting job — 36 of them built of Monel metal to prevent corrosion. Photo above shows a Clarage skilled worker completing one of the fan housings. Our 25 years' experience counts!

WHEN you have any type of "air problem", remember the name CLARAGE. This name ranks high in the air handling and conditioning field.

We manufacture fans, blowers, mechanical draft apparatus, unit heaters, coolers and conditioning equipment for every need — products seasoned by over a quarter-century of experience.

Your requirements entrusted to us are in EXPERT hands — and that always means RESULTS with UTMOST ECONOMY.



NEW HIGH-SPEED, HIGH-EFFICIENCY DESIGN — Even on the simplest exhaust fan application, it pays to consult Clarage. The use of our new Type W Fan can make possible as high as a 25% reduction in size of motor required for drive — and invariably operating costs (power consumption) are below normal expectations.

CLARAGE FAN COMPANY

KALAMAZOO, MICHIGAN

Sales Offices in All Principal Cities

"No More Hose Troubles"

Premature hose wear creates unnecessary high cost, interrupts operations and impairs workmen's efficiency. Mechanical rubber hose should give long service in spite of hard usage and ordinary abuse that are a natural result of proper application.

Republic Hose for conducting air, water, steam, gasoline, oil, chemicals, gases, etc. for suction or high pressure applications can be relied upon to give full value in length of service. Wherever premature hose wear has been experienced, Republic Hose will put a stop to this source of expense.

Workmen in every branch of American industry know from experience that Republic Hose is dependable. They look to it as the best means of ending their hose troubles.

REPUBLIC RUBBER

Division OF LEE RUBBER AND TIRE CORPORATION

YOUNGSTOWN, OHIO

Manufacturers of HOSE
BELTING • PACKING
MOLDED PRODUCTS

ORDER REPUBLIC RUBBER PRODUCTS FROM YOUR DISTRIBUTOR

Phone Systems Within Plant

(Continued from page 72)

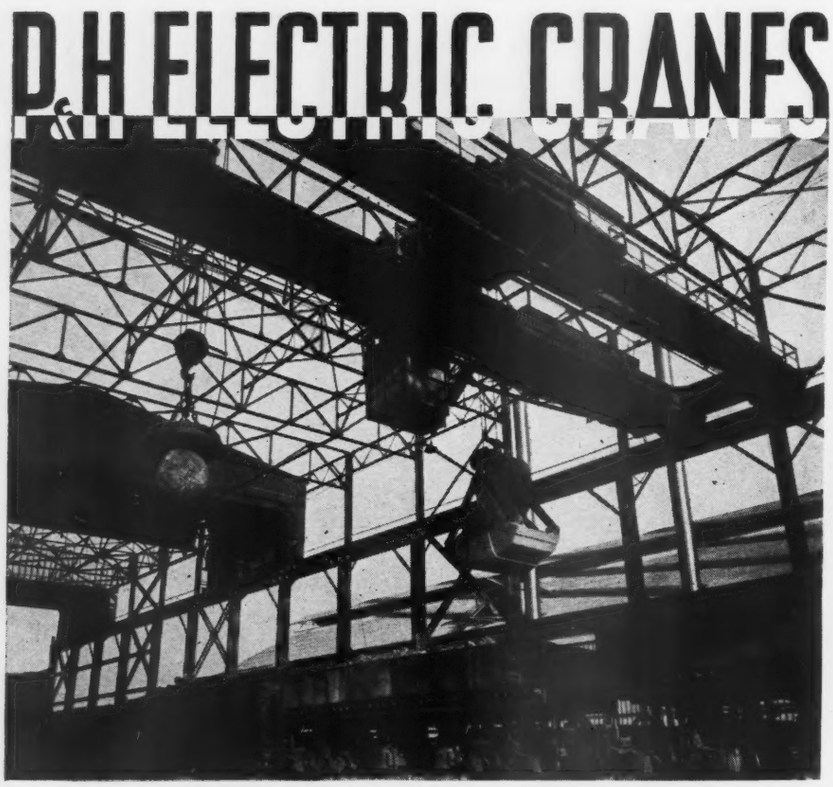
cells or, where 110-volt, 60-cycle alternating current is available, a telephone rectifier equipped with the proper filter and choke coils may be used.

The ringing circuit comprises simple vibrating bells connected to the pushbuttons of all stations.

For convenience in wiring a cable having twelve No. 22 B&S gage, silk-and-cotton insulated wires is available with an outer covering of lead for use in damp locations or where wiring in conduit is desired. A similar type of cable with an outer covering of flame-proofed cotton may be used for exposed wiring in office and dry locations. All conductors of both these types of cable are color-coded; so it is a simple matter to find the wires required for the connections at each station.

An installation of this type can be put in at a cost of between $50 and $60 a station, depending on the size of plant to be served, and the amount of cable required between stations.

(In a succeeding article, to appear in an early issue, selection of a suitable intercommunicating system for a somewhat larger plant requiring full selective-ringing-and-talking service will be discussed.)



–10,000 OF THEM

Last month the 10,000th crane left P&H shops. Though this is a small figure, when compared with automobile production, for instance, it is far and beyond the all-time production records established by any other crane builder. This, in turn, is concrete evidence of P&H's first half century of leadership in the overhead traveling crane industry. It is strong testimonial of the confidence you may have when you come to P&H for consultation on your specific handling needs. Harnischfeger Corporation, 4525 W. National Ave., Milwaukee, Wis.

Overhead Traveling Cranes, 1 Ton To 300 Tons.

HARNISCHFEGER
CORPORATION
HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

Organized to Prevent Breakdowns

(Continued from page 70)

This time card shows the job number and gives the hours spent on each operation. After it has been checked against the regular time clock card the hours spent on each job are recorded on the back of card shown in Figure 2 as a permanent record for future reference. In this way, we have a record of the actual cost of each job performed by the department, as well as the name of the workman.

The form in Figure 5 is used for the approval of overtime work. The purpose of this card is primarily to discourage the promiscuous use of overtime. As indicated, the department head must secure the approval of the superintendent before he can request that any specific job be done on overtime, excepting emergency breakdown or repair work.

Every piece of equipment in the plant carries an inventory number. This number is recorded on the card shown in Figure 6. All major repairs are noted on the reverse side of the card, with the date and cost. Space is also provided to show the final disposition of the equipment; that is, whether it is sold, junked, or transferred. This card file is cross-indexed with a looseleaf logbook. The logbook enables us to tell at a glance whether other similar items of equipment or spare equipment are available in the event of breakdown. These records also enable us to maintain an inspection log covering the general condition of equipment.

Oiling Data

Lubrication records are kept by a card system which gives information pertaining to oil changes, type of oil required, and covers the regular inspection and work performed by the oilers. We have never had a special form made up for this purpose, but have used a ruled card of standard size, with the information set up and itemized by numbers so as to tie in with our equipment records.

Results of electrical inspection are recorded in a looseleaf logbook and handled by the foreman of the elec-

Good Seeing is Good Business

...WITH MODERN COOPER HEWITT LAMPS

Human eyes are industry's most critical control devices . . . For this reason, if for no other, their well-being is *always* good business. Economizing on lighting is similar to economizing on lubricant for machines.

Good lighting conquers visual strain, it makes work safer, makes surroundings cheerier, and ends the nervous tension that comes from eye fatigue. Employees *see* better, *think* better, *feel* better and *work* better when lighting is engineered to the job. It's one efficiency item that everybody welcomes . . . At the end of a shift in the well-lighted plant, employees leave their work clear-eyed, visually fit for hours of recreation and home life.

Now, too, with the new Cooper Hewitt* Lamps "high seeability" lighting is less expensive than ever before. Plants where costs are known down to the last penny are installing Cooper Hewitts right now—as a means of spreading slim modernization budgets wisely as well as widely throughout the plant.

Why not discuss the possibilities of similar gains in your own plant with a representative who knows the economics as well as the engineering of modern industrial lighting? General Electric Vapor Lamp Company, 815 Adams Street, Hoboken, New Jersey.

*The new Cooper Hewitt starts instantly . . . hangs horizontally . . . gives the same output from 22% less wattage than previous types. It provides a soft, detail-revealing light for non-fatiguing seeing.

GENERAL ELECTRIC VAPOR LAMP COMPANY

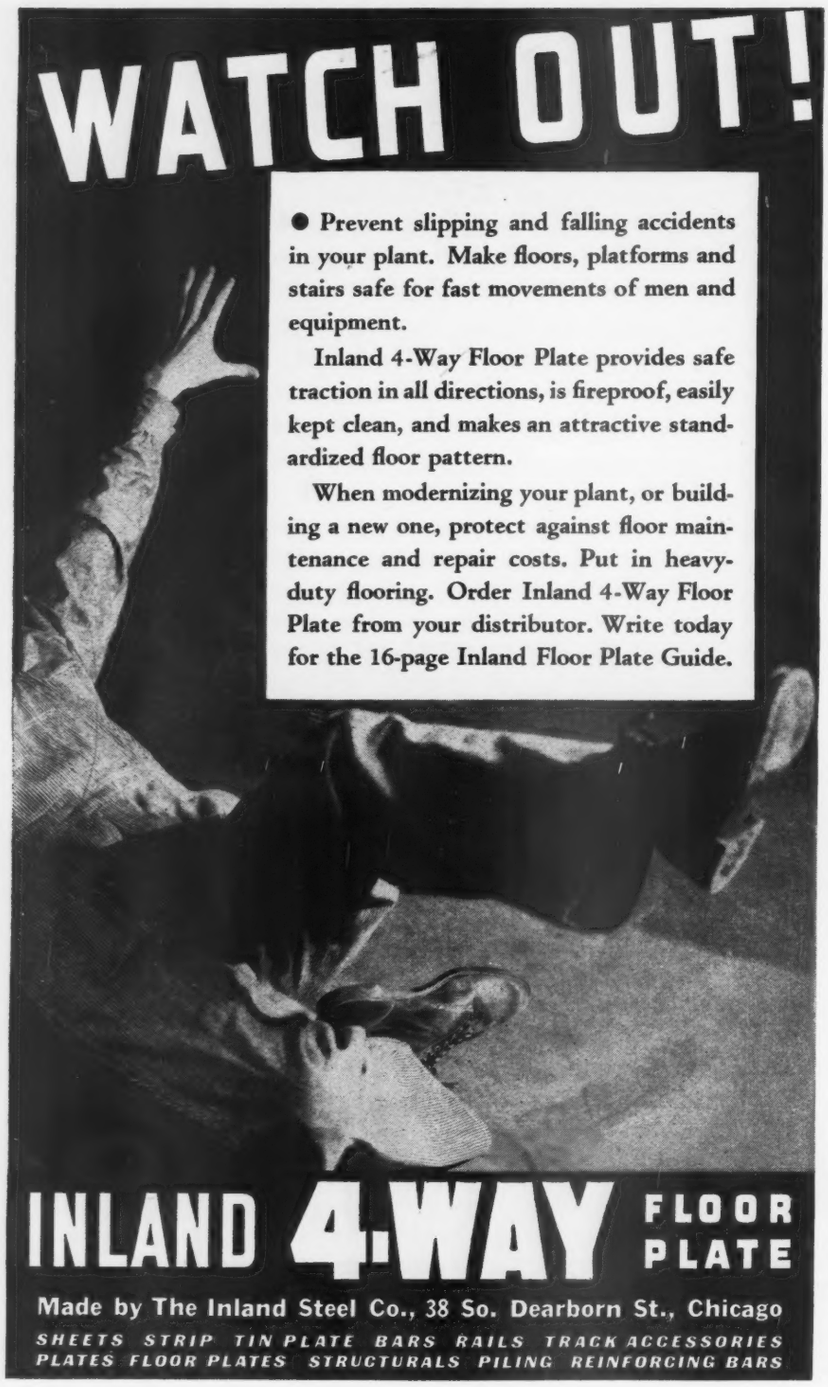
908C

tricians. This book is indexed so as to conform to our inventory records and all information pertaining to repairs, cleaning, and replacement of parts of the electrical equipment is kept in it.

In Figure 7 is the form used for notifying the main office of changes in the location of equipment, so that the necessary transfer can be made on the inventory records. It is essential to maintain a perpetual inventory of all equipment. It is also important that this record be kept up-to-date, so that the company's records can show the true value of equipment in each building in the event of loss by fire.

Figure 8 shows the supply requisition which is issued by the department heads to the supply room in connection with the maintenance department, for supplies which they may require, such as small tools, brooms and pails. This record provides a means of properly charging the department with any articles taken from stores.

The foregoing procedure does not of course apply to emergencies of any kind. Work orders of this nature are sent direct to the control office. Or, in case of breakdown, the information is telephoned and the work order card is made out and sent in later.


WATCH OUT!
● Prevent slipping and falling accidents in your plant. Make floors, platforms and stairs safe for fast movements of men and equipment.
Inland 4-Way Floor Plate provides safe traction in all directions, is fireproof, easily kept clean, and makes an attractive standardized floor pattern.
When modernizing your plant, or building a new one, protect against floor maintenance and repair costs. Put in heavy-duty flooring. Order Inland 4-Way Floor Plate from your distributor. Write today for the 16-page Inland Floor Plate Guide.
INLAND 4-WAY FLOOR PLATE
Made by The Inland Steel Co., 38 So. Dearborn St., Chicago
SHEETS STRIP TIN PLATE BARS RAILS TRACK ACCESSORIES
PLATES FLOOR PLATES STRUCTURALS PILING REINFORCING BARS

Watch Insulation Resistance

(Continued from page 79)

take comparative voltage readings of (1) line volts and (2) differential volts when the meter is connected in series with the insulation to be measured across the line.

With this method the following formula applies:

$$R_1 = [R\ (E - E_1)] \div E_1$$

Where:

R_1 = Insulation resistance, ohms.

R = Voltmeter resistance.

E = Line voltage.

E_1 = Voltmeter reading when connected in series with R insulation across line voltage.

Method 4 also requires an outside d.c. voltage source. It is an excellent method for very accurate readings, but is usually confined to laboratory tests. When it is used the following formula applies:

$$R = V \div A$$

Where:

R = Insulation resistance, megohms.

V = Line voltage.

A = Micro-amperes flowing through insulation.

In taking insulation resistance readings and recording them for future comparison the following procedure is recommended:

1. Record the temperature of each winding at the time the insulation resistance is observed. It is important to place the thermometer in a spot where a reasonably accurate temperature measurement will be obtained. This spot should be marked on the machine or recorded in the test record and all subsequent measurements taken there.

2. Measure and record the insulation resistance of each winding separately, preferably by methods 2, 3, or 4.

3. Indicate any special conditions observable about the machine such as:
   (*a*) Dirty insulation.
   (*b*) Oil accumulation.
   (*c*) Surface moisture.

4. Record approximate humidity conditions at the time of testing. For example, indicate "damp", "average" or "dry" atmospheric conditions.

5. Make a summary of all these factors, tabulating the observed data. Then plot the insulation resistance against temperature on a semi-log curve, as described previously. Or, if this cannot be done, correct the insulation resistance reading for temperature using the fore-

"Getting him back to work is worth ten times the insurance cost"

"You see, the actual insurance — the settling of workmen's compensation claims — is only part of the story.

"What is of more interest to me is the help American Mutual gives us — in a medical way — to restore the job-holding abilities of injured workers. Their specialized doctors, being familiar with the requirements of an industrial job, can direct the treatment with the job in mind and bring back to work a man who might otherwise be permanently unfit.

"So — instead of an existence of idleness, supported by insurance — that man out there whose experience is worth ten times our entire premium cost, is back earning his living — of use to himself, of value to us."

American Mutual, the country's *first* liability insurance company, offers to employers, in addition to medical rehabilitation, two other opportunities to profit:

. . . **from safety engineering.** Going beyond the application of mechanical guards at dangerous places, we help you, economically, to organize men, methods, and machinery according to the principles of practical safety, eliminating uninsurable indirect losses and often reducing insurance cost.

. . . **from cash dividends.** Our savings are your profits. By dealing direct with our own salaried salesmen, by helping to reduce accident losses, by sound financial management, our savings have always been sufficient to return each policyholder one-fifth or more of insurance costs — *regularly for 50 years.*

American Mutual has branches in 56 of the country's principal industrial centers. In addition to Workmen's Compensation, it offers opportunity for savings on Automobile, Fidelity Bond, and practically all other lines of liability insurance.

Admitted Assets: $34,866,615.84 *Liabilities:* $29,443,222.08
Surplus to Policyholders: $5,423,393.76 *As of Dec. 31, 1937*

Savings even greater than 20% have been regularly made on Fire Insurance, written by our associate, Allied American Mutual Fire Insurance Co.

American Mutual

works to make all work safe

AMERICAN MUTUAL LIABILITY INSURANCE COMPANY

"How Twelve Companies Saved More Than a Million Dollars" is a free booklet describing this lowest net cost insurance. Address Dept. 54, Boston, Massachusetts

going formula and reduce all values to the same basic temperature, so as to make them truly comparable.

Once such comparative data have been obtained for a particular machine or type of machine, insulation resistance measurements take on a new meaning. When coordinated with the temperature of the machine, the insulation resistance clearly indicates the condition of the insulation. If successive readings indicate a tendency toward lower relative insulation resistance, preventive maintenance is indicated before a service interruption occurs. Low relative insulation resistance indicates deterioration of the insulation or the presence of moisture or dirt.

Periodic Checking Counts

Any of these conditions is detrimental to the safe operation of the machine and tends at best to shorten its life. When detected in time they may be corrected and the apparatus cleaned and dried out and, if possible, dipped and baked to restore the insulation.

Careful and periodic checking of insulation resistance, and comparison with known standards for definite temperatures, will give a true picture of insulation deterioration. From such data kept in understandable form, a logical and adequate maintenance program can quickly be worked out.

THE Colson Lift Jack system for materials handling provides extreme stability, even for greatly unbalanced loads. With the positive pin and socket coupling between jack and platform there is no possibility of an unbalanced load tipping.

Two simple units make up the Colson system:

1. A platform with wheels on one end and legs on the other.
2. A twin-wheeled jack that engages the front end of the platform and converts it into a sturdy, easy-to-roll truck.

Another remarkable feature of the Colson System is its low cost. As little as $150 will put a Colson Lift Jack and several platforms to work for you. Ask for a Colson representative who will gladly show you how the Colson system cuts handling costs.

THE COLSON CORPORATION
3707 CEDAR STREET • ELYRIA, OHIO

SEND FOR FREE BOOKLET
The essential facts of Colson Lift Jacks are explained in the booklet: "Colson System of Materials Handling." Write for a copy.

COLSON LIFT JACK SYSTEM

Push-and-Pull Fume Removal

(Continued from page 77)

the tanks. The opening through which the air is discharged is ½ in. in width. At the top, the duct is 13 in. in width and, with the ½-in. opening, the direction of the air is changed and turbulence prevented.

The tunnel duct leading from the hot air fans and passing between the tanks is covered with monel metal to protect it from the acid splashed on it as the racks of steel sheets are moved from one tank to another.

Pickling operations are conducted in a building that measures 461x320 ft., the height from the floor to the bottom of the roof trusses being 35 ft. However, 100,000 c.f.m. of air cannot be exhausted even from a building as large as this without adequate provision for replacing it with an equal amount of air, if objectionable drafts through doors and windows are to be avoided.

To supply this deficiency and thus avoid any draft, three banks of heater coils were installed at the opposite end of the building, about 425 ft. away. These air heaters are located near the roof and are 100 ft. apart, so that the fresh air is distributed across the width of the building and high enough up to cause no draft. Air is taken from the outside, tempered, and distributed by a gradual movement from one end of the building to the other.

The results obtained with this installation have been most gratifying. Working conditions around the pickling operation now are as pleasant as those found anywhere else in the press shop.

Maintenance costs have been greatly reduced since all steelwork and the overhead materials handling systems are entirely outside the fume level. In fact the only repairs needed, due to attack by acid fumes, will be on the wooden ducts and exhaust stack. And they will be a minor item as long as the surfaces are protected by acidproof paint.

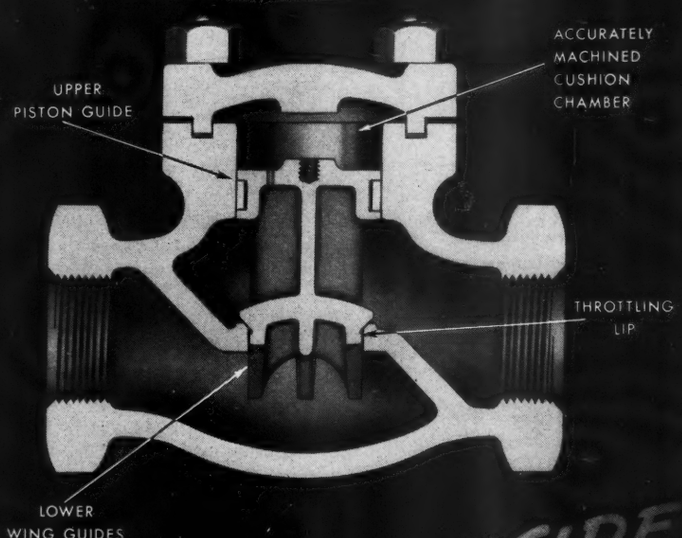
It frequently happens that a change made for one purpose permits other equally desirable changes to be made. That was true in this case.

(Continued on page 128)

CUSHIONED CHECK VALVES

for Unusual Service IN POWER PLANTS AND FACTORIES

Crane No. 1507½ Ferrosteel Cushioned Check Valve. Cross section shown below.



IT'S WHAT'S INSIDE THAT COUNTS!

Step out into the plant—any plant, on process lines—power lines—wherever the flow of liquids and gases is controlled, you will find check valves. Their function—preventing dangerous back flow—is most vital in many piping systems. And because the conditions which they must meet vary widely, check valves deserve more care in selection than valves of any other type.

Regardless of the service, there is a Crane Check made to meet just those conditions. For example, consider those lines where pulsations in flow or intermittent service cause a serious slamming of the disc, which quickly destroys valves or necessitates extensive repairs. Here the Crane Cushioned Check offers distinct advantages. It freely permits flow, but cushions the pulsations and permits long, economical service. Every Crane Check has back of it the Crane resources of skilled engineering, extensive laboratory tests, quality manufacture and careful inspection.

When you need check valves, be sure to get the recommendation of the Crane Representative. Also, ask him for a copy of "Checking up on Check Valves," Crane's new booklet, which will be a real help to you in understanding the many different types of check valves and in selecting the correct type for the service you require.

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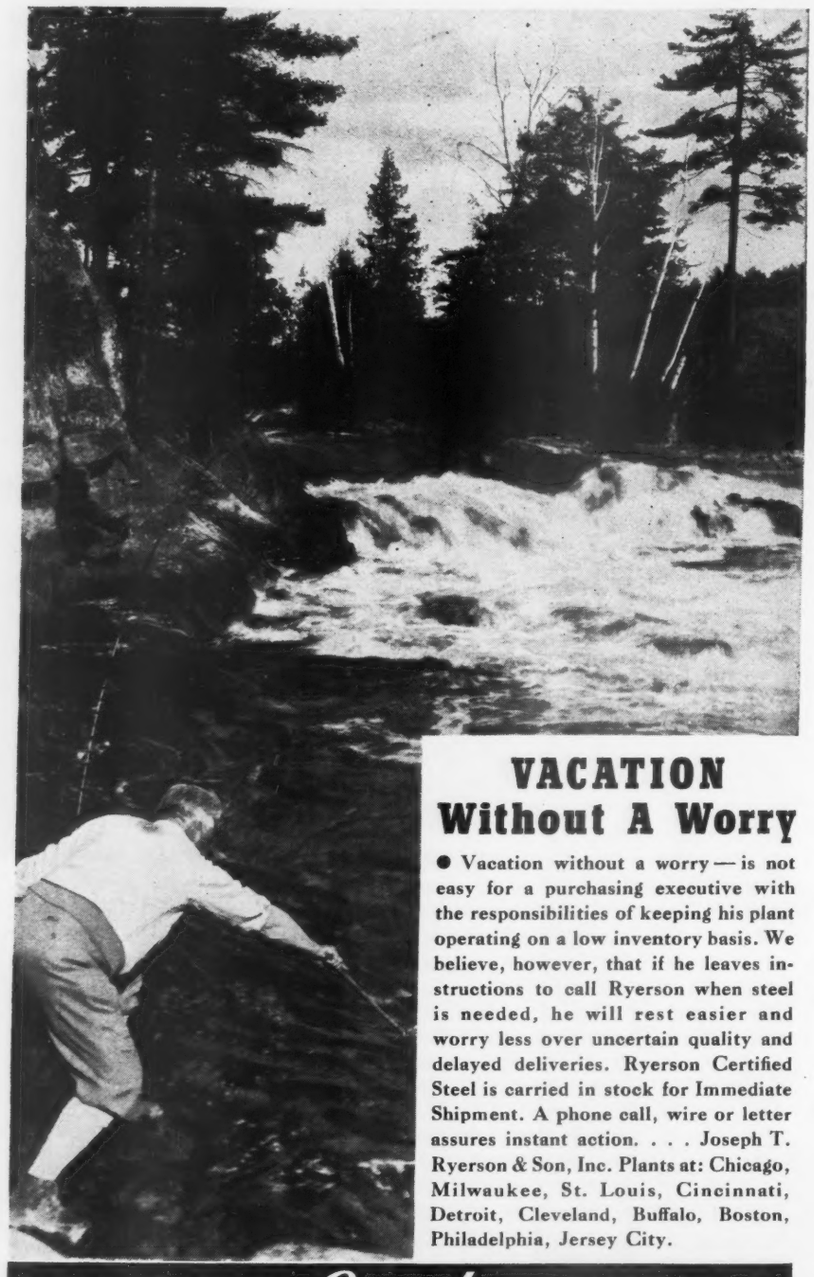
(Continued form page 126)

Removing the hood from above the tanks, except for the 1½-ft. extension over the back, and replacing the air hoists by an electric hoist running on a monorail loop, permitted arranging the tanks for progressive movement of the material.

Four pickle tanks are now placed side by side, followed in turn by tanks for cold water rinse, alkali neutralizer, and hot water rinse. The crane operator picks up a rack of stock from the loading dock placed under the outer section of the monorail and lowers it into a pickle tank. When the rack has been in the acid for the proper length of time the pickler signals the crane operator to move it to the rinse tank. From this tank the rack is moved successively through the tanks just mentioned, and after leaving the hot rinse tank it is moved ahead to the unloading station.

This process is, of course, continuous. Waiting time necessary under the old system has been eliminated, since the crane operator is moving racks of stock through the rinse tanks while other racks of stock are being pickled in the acid tanks.


VACATION
Without A Worry
● Vacation without a worry — is not easy for a purchasing executive with the responsibilities of keeping his plant operating on a low inventory basis. We believe, however, that if he leaves instructions to call Ryerson when steel is needed, he will rest easier and worry less over uncertain quality and delayed deliveries. Ryerson Certified Steel is carried in stock for Immediate Shipment. A phone call, wire or letter assures instant action. . . . Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.
RYERSON Certified STEELS

Low Inventories, Because

(Continued from page 66)

plies or office expense must be in line with activity of factory and costs for corresponding quarters in the past. Breaking down costs of raw materials and supplies to 40-odd subtotals shows up many points worthy of checking by the works manager.

Up or Down? And Why?

Controlling supplies and materials is, after all, largely a matter of inventories. Are they up or down, and why? Supplies are purchased from hand to mouth, at no extra expense because of the factory's location in the Metropolitan district. There is therefore no real inventory of supplies. Everything on hand is in actual use. Hence control of supplies is entirely a matter of watching prices on individual purchases.

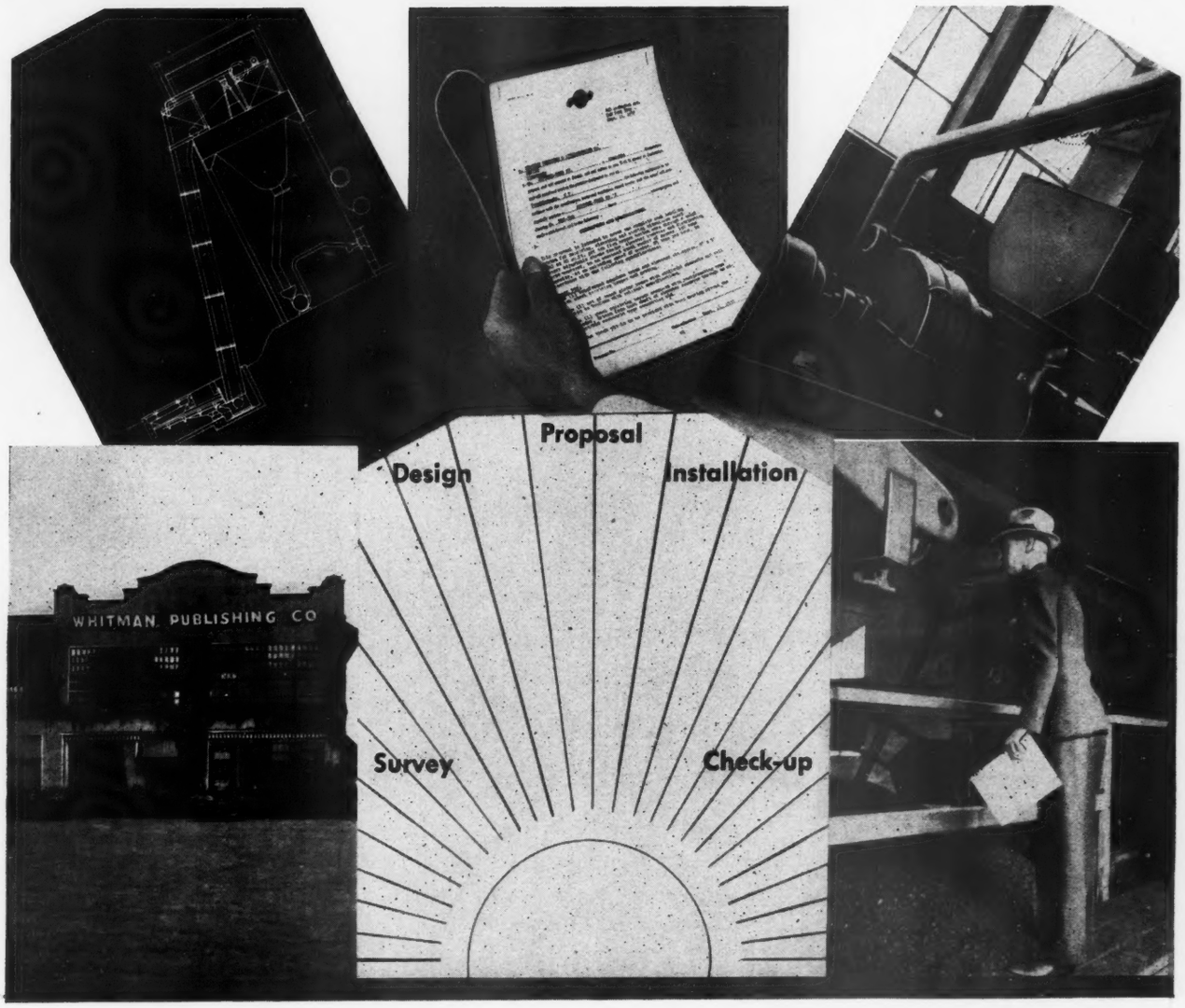
Requisitions (Figure 3) for steel, brass, wire, and other major raw materials are written up by the production department, and are sent to the works manager with the "Perpetual Stock Record" card for each item (Figure 4). Each requisition shows quantity on hand, total applications, amount used in the months of the current year, and amount used the previous year. Also shown is whether the item is required for a stock or a customer's order. The quantity to be ordered is left blank, to be filled in by the works manager.

Always in Balance

The amount ordered is a balance between three factors, actual quantity that must be purchased, quantity required to obtain a substantial reduction in the quantity penalty, and money available for raw materials from budget allotment. Actual quantity that must be ordered is the difference between the quantity applied and the quantity on hand. Greater latitude can be taken on a stock order than on an actual customer's order.

The "Perpetual Stock Record" shows the speed and quantities of withdrawals of item from stock into factory. With this information, the economical quantity to buy to obtain the least quantity penalty can be determined.

Finally, is the money available to take advantage of a quantity discount? Obviously, if monthly commitments must be kept in line with a budget allotment, not all discounts can be taken, as items to be reordered have a strange way of com-



TIME, SPACE AND COST SAVINGS

MADE CERTAIN AS SUNRISE

Wherever better material handling methods can save time, space and money, the Gifford-Wood five-point plan makes it certain as sunrise that the savings will be made. The G-W plan offers you—

1. **A complete survey of your plant—your materials and requirements.**
2. **A comprehensive system design—individually for you, including the latest time, space and money savers.**
3. **A complete proposal—with layout, specifications, investment required, operating cost and performance.**
4. **Installation—careful and complete.**
5. **Periodic Check-up—by competent men—to keep your equipment at top efficiency.**

Whatever you regularly or periodically move in quantity into, within or out of your plant—whether coal and ash, bulk materials, parts in process, or finished products in bulk or containers—Gifford-Wood experience, facilities and personnel, under the unique five-point plan, make it certain as sunrise that you win. A discussion puts you under no obligation, may lead to important economies. When would it suit you to have us call?

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ing up in bunches, and judgment must give way to cash available.

All the above is possible, and here is the real secret of the low inventory—the time element is not involved. It is the time element that creates large inventories, and when a wrong guess as to future use is made, the obsolete stock list gains a new item.

The set-up removing the time element was obtained by analyzing yearly requirements in brass, wire, and cold-rolled steel; by finding a supplier of each class of material who agreed to give prompt service on short notice; and by vigilant correction of items and cooperation with the suppliers to keep a 36-hour service on brass, a 48-hour service on wire, and a 5-day service on cold-rolled steel.

Results count. The success of the above control of materials is attested by the fact that material requisitions wait upon actual customer orders—in an industry where service is the major sales argument.

(A second article, to be published soon, will describe the production control plant that was set up in this same branch plant.—Ed.)

PROVIDE complete protection against tramp iron troubles by installing an EC&M Separator Magnet above or at the discharge-end of your conveyor; also designed for under-chute mounting.

Because of their powerful concentration, these Separator Magnets remove small pieces of iron buried in the stream of material as well as large pieces, such as bolts, hammer heads, etc. They provide the strongest flux directly over the center of the conveyor belt where the material is usually the deepest.

Moderate in first cost and with no moving or wearing parts to develop trouble, an EC&M Separator Magnet will perform faithfully year in and year out, paying for itself very quickly by elimination of damage to machinery and delays to production. Ask for illustrated Bulletin 910 describing EC&M Separator Magnets.

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